FEBRUARY 1967 35 CENTS

Popular Science

MONTHLY

WIN A CAR and 1,000 gallons of gas! Play Spot-the-Cars Game... SEE PAGE 112

How Do They Do It?
The Tricky Mouse on the ED SULLIVAN Show

Fun Cars You Can Build from a Kit ⇨

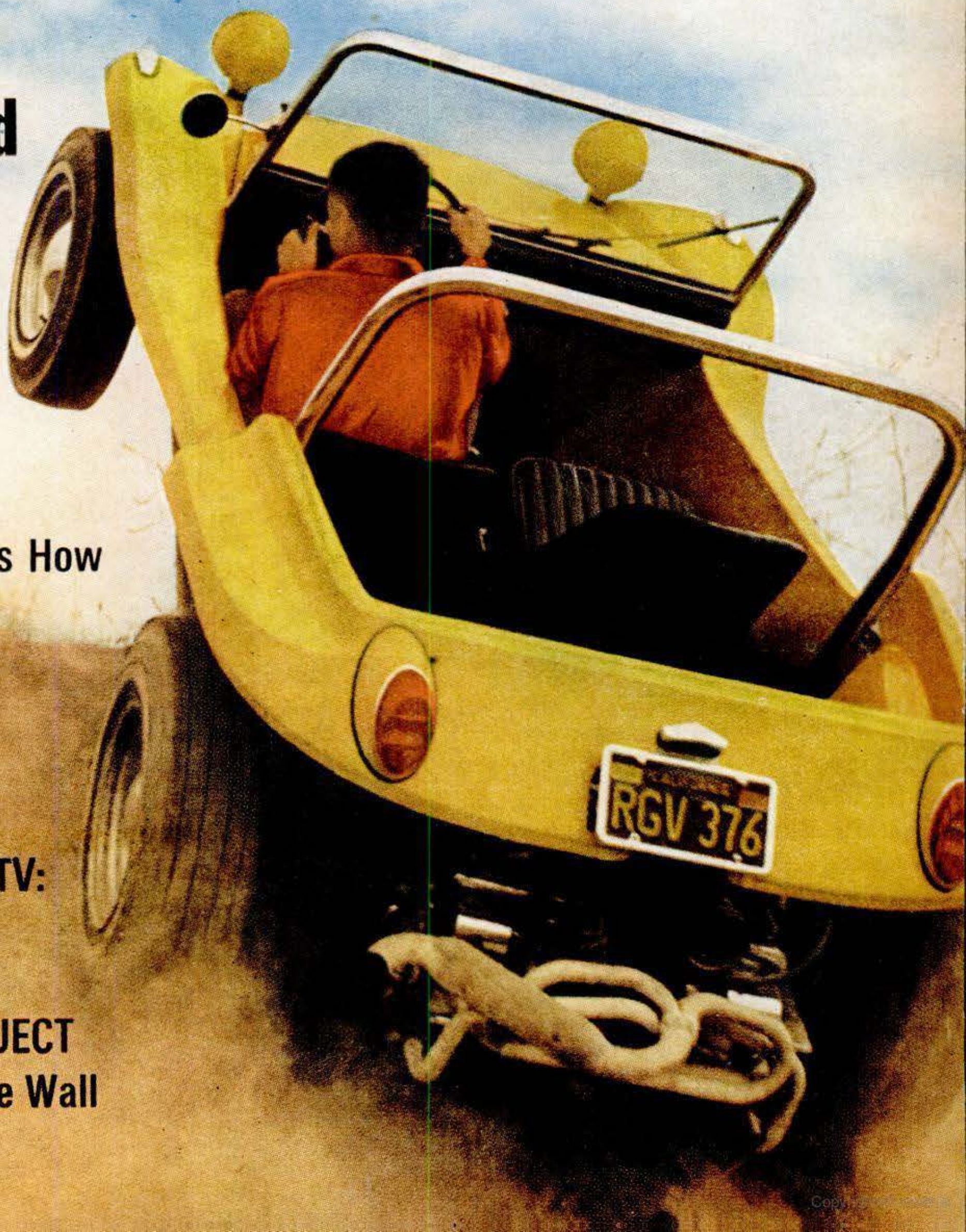
Best Finishes for Fir Plywood

STOP SKIDDING!
New Research Shows How

MARIO ANDRETTI
Tests the New Pontiac Firebird

Gadgets to Improve TV: Are They Any Good?

PS BLUEPRINT PROJECT
Family-Room Storage Wall

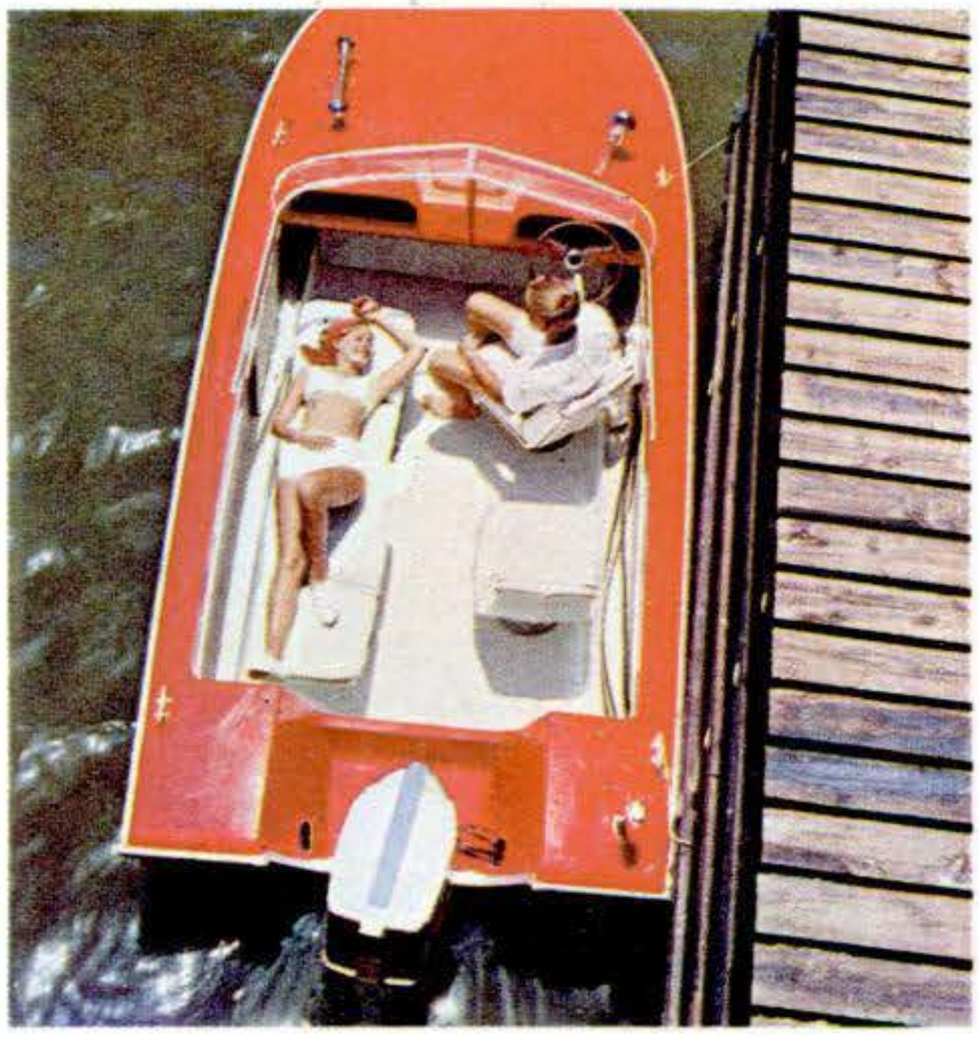


THE CHRYSLER CREW COMES THROUGH FOR YOU!

NEW...CHRYSLER HYDRO-VEE'S ...MORE FUN PER FOOT

17-foot Courier 229. The "229" indicates hull capacity—229 cubic feet,. by official Boating Industry Association formula! More fun per foot.

SMOOTH AND SAFE! Deep-V takes crunch out of waves; strakes and delta "wing" help hull skim surface for smooth planing. Foam-Pac fiberglass construction adds safety to your family boating fun.



SMART! Color-coordinated interiors; swiveling-reclining bucket seats; high fashioned for style and comfort with sport-car wheels and teak-grained instrument panels.

Combine the best of the deep-V with the best of the hydroplane, improve them with Chrysler engineering . . . and what've you got? The new Chrysler Hydro-Vee hull! It rides softer than a V, planes and corners like a hydro; and it's steadier and more stable than either. It's a beauty—inside and out. Your new Chrysler Hydro-Vee can be a 14-, 15-, 16-, or 19-foot runabout; a 17-foot bow-rider; or a 23-foot Sport Cruiser. With outboard or inboard-outdrive power! For more fun per foot, see your Chrysler Boat dealer! Chrysler Boat Corporation, Plano, Texas.

SEE CHRYSLER HYDRO-VEE'S IN ACTION ON NBC-TV'S "TODAY" AND "TONIGHT" SHOWS

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BOAT CORPORATION

CHRYSLER MARINE PRODUCTS—BOATS, TRAILERS, OUTBOARDS, INBOARDS, AND INBOARD-OUTDRIVES

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"I won't buy a Renault no matter how good it is."

"...no matter how good it is." Isn't that just superb?

The reasoning behind that statement is sad enough. But what's really tragic about it is that we helped bring some of it on ourselves.

A few years ago, we admit, some Renault cars and dealers fell a trifle short of perfection. So we can appreciate why a few former owners swore they'd never buy another one ...a few years ago.

What we can't appreciate is why they're still talking like that.

You see, we did some swearing of our own.

We fixed everything that needed fixing and then some. When you're the seventh largest carmaker in the world, you don't just sit around wringing your hands.

In fact, if everything weren't absolutely A-1 now, do you think we'd be talking about it?

The February '67 issue of *Road Test Magazine,* for instance, a kind of consumer guide for car buyers, rates the Renault 10 ahead of all other imports in its class.

Unfortunately, the problem doesn't end with former owners. Some people who know nothing about our troubles of a few years back have also sworn off Renault.

Oh it's nothing personal, mind you. They simply hate all little foreign cars.

Typically, they've ridden around in a friend's little car. (Those people know who they are and they know what little cars we're talking about.)

So they're absolutely certain that any car for $1647* has to be a noisy, hard-riding little machine.

Anyway, with all the swearing going on for one reason or another, many people won't even test drive the Renault 10.

And that's a shame.

Because if ever there was a car to make all the swearing stop, it is the Renault 10.

RENAULT

The Renault 10

*East and Gulf Coast P.O.E. Slightly higher on West Coast. Whitewalls and AUTOMATIC TRANSMISSION optional. For nearest dealer or information on overseas delivery, write Renault, Inc., Box 11, 750 Third Ave., NYC 10017

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FEBRUARY 1967 Founded in 1872/Vol. 190 No. 2

HIGHLIGHTS OF THIS ISSUE:

Cover Story: Fun Cars You Can Build from a Kit PAGE 61
Always wanted to own a go-anywhere car? Put together one of these little poppers.

The Tricky Mouse on the Ed Sullivan Show PAGE 68
If you've wondered what puts the life into frisky, lovable Topo Gigio, here's the answer. A three-man PS team went behind the scenes to bring you the story.

New Research Is Whipping Your Greatest Driving Hazard PAGE 80
Stop skidding! Learn the rule-of-thumb formula to avoid deadly "hydroplaning."

Gadgets to Improve TV: Are They Any Good? PAGE 118
We bought a bucketful of them, installed and tested them, then took 'em apart to see just what goes on inside. Here's what we found out.

Smart Tricks for Finishing Fir Plywood PAGE 164
Firply, a handyman's best friend, is also difficult to finish. Here's how you do it.

COVER PHOTO BY JAMES W. WRIGHT

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COMING NEXT MONTH

If you're a man who likes to keep up with what's going on, you'll get a kick out of March Popular Science—it's loaded with news and know-how on everything from Project Apollo right down to your own back yard. Here's a sampling from next month's line-up:

- How to Be an Expert Night Driver
- A Big Save-It Section on Easy Math Tricks You Can Use Every Day
- A Stunning Full-Color Portfolio on Motor Racing . . . the Grand Prix Circuit . . . Indy . . . Sports-Car Racing . . . Stock Cars . . . Road Rallies
- How You'll Fly in the Jumbo Jets
- Around the World with Color TV
- Boating Ideas from PS Readers
- The Case for Buying a Reel Mower
- Norbye/Dunne Report: The Not-So-Compact Cars
- The Latest Article in Our Wood-Finishing Series: Now Everyone Can Use Lacquer
- Easy Auto-Body Repairs You Can Do Yourself
- PS Lie-Flat Blueprint Project: A Redwood Canoe You Can Build

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Special offer to pipe smokers who smoke these brands

First of all, congratulations on your good taste. They're fine tobaccos every one.

But I'll bet that, like most pipe smokers, every so often you get the urge to try something different.

And so Kentucky Club Mixture makes this offer. If you're in the mood to try a remarkably mild and aromatic mixture, one of the fastest growing brands in America, send us the empty pouch you've just finished and you'll receive a fresh pouch of Kentucky Club Mixture.* Free.

It's an offer you ought to consider if you're a serious pipe smoker. Here's why.

1. Kentucky Club Mixture is probably the mildest aromatic pipe tobacco around. Most smokers can enjoy pipeful after pipeful without "bite".

2. It's a clean, easy-to-light tobacco that's cut to stay lit right down to the bottom of the bowl.

3. The aroma is pleasing to most everyone. Especially women.

4. Most important, the flavor is smooth and rewarding. The result of the careful blending of 5 important tobaccos: White Burley, Virginia Brights, Weeds Cavendish, Turkish and Perique, plus a dash of Deer Tongue for flavor. (Deer Tongue, by the way, is a variety of wild vanilla. It's used as seasoning The way you might add salt to stew.)

So that's it. Kentucky Club Mixture is a mild aromatic blend made by people who believe it's best and are ready to prove it by sending you a supply.

For your free pouch mail your empty to: Kentucky Club Mixture, Box 6666C, Wheeling, West Va. And when you've smoked it, write and let us know how you like it.

Kentucky Club Mixture

*Unfortunately we can't picture all tobaccos. But the offer's good on any brand (except Kentucky Club Mixture). Offer good in U.S.A. and Canada only.

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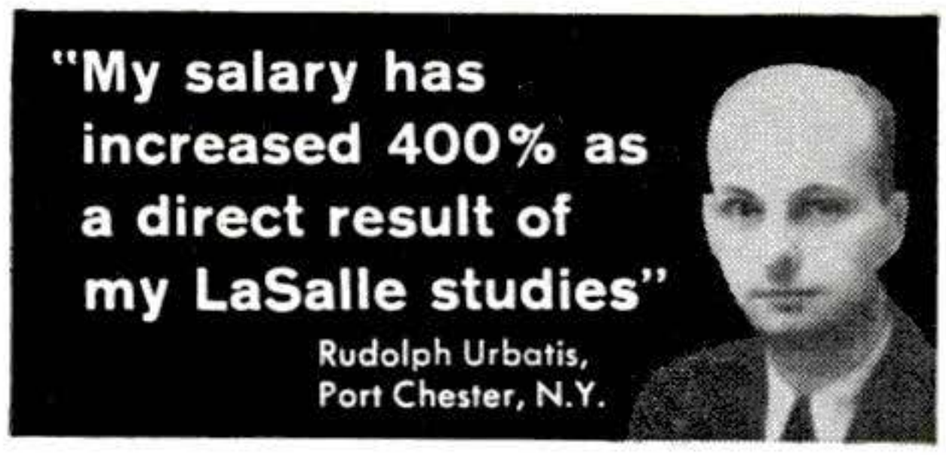

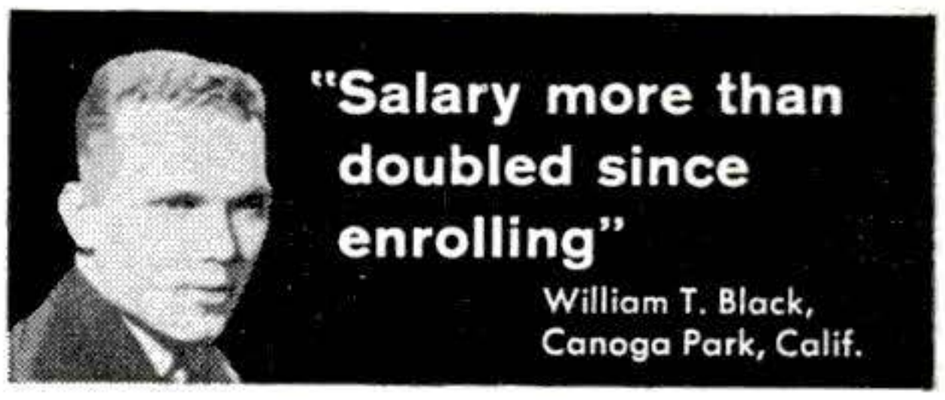

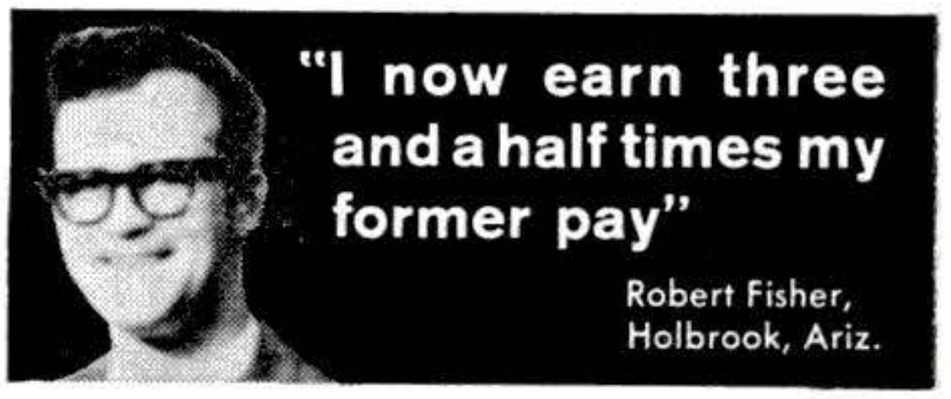

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PS Readers Talk Back

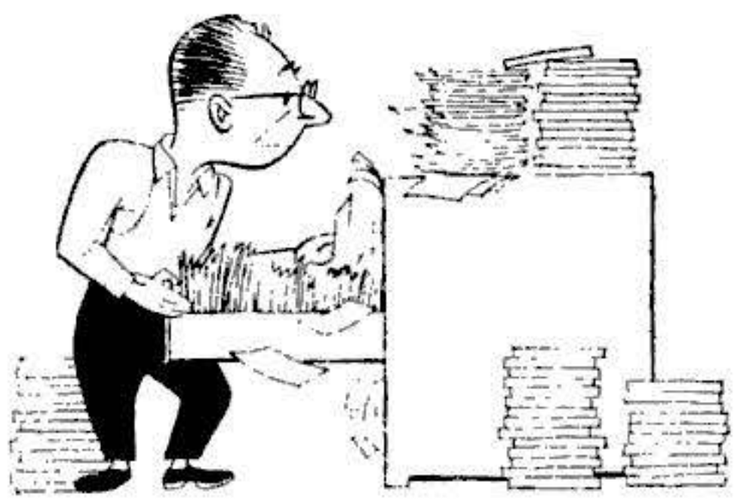
Want to get something off your chest? Write "Readers Talk Back," POPULAR SCIENCE, 355 Lexington Ave., New York, N.Y. 10017.

Ideas for hobbyists

I have been a PS reader for years and spend many hours in my hobby shop. I enjoyed "From Outer Space to Basement Workshop" [Nov.] in which Dr. James A. Van Allen expresses the enjoyment and relaxation he experiences from the use of his shop tools. I, too, get a lot out of creating something from wood, or repairing broken furniture. At the same time it affords me a way to forget worry and strain. I have many pieces of handcrafted furniture, and finishing them often is a challenge. Jackson Hand's article "How to Use Stains to Get the Color You Want" [Nov.] is most instructive on this problem. I have used some of his recommendations and found them very good. Let me thank you for an excellent magazine. Its articles are educational and may suggest a fine hobby, so necessary for men with spare time and energy, or who, like myself, need a means of relaxation.

FRANK H. THOMAS, West Liberty, Ohio.

. . . For many years I have gotten good ideas from PS. Some I use as they are, others I modify. A number of years ago, I built a three-drawer file cabinet. As my magazines ac-



cumulate, I review them and clip and file what I want to keep. No doubt by the time I am ready for retirement I will have plenty of ideas to last me a long time. Keep those good articles coming.

MONTFORD M. KEPLER, North Canton, Ohio.

Steamed up over marine engine

In "New Hustle-Packed 80-Horse Hitch" [Dec.] you say a thermic-cycle test of 50 hours of operation of the MerCruiser 80 was made at 4,650 r.p.m. under full load, with sudden water-temperature variations from 40- to 110-degrees C. This is an impossibility. Any chemistry student will tell you that water boils at 100-degrees C., so at 110-degrees C. there would be only steam. Mercury certainly must build a rugged unit to pass this test.

REED JEROME, Houston, Tex.

And any chemistry student should know that the boiling point of water varies with pressure. All you have to do to test the cooling system at extreme temperatures is pressurize it.

On taking smart pills

All my life, I have heard the joke: "You ought to take some smart pills." Now I see in "Can This Drug Make You Smarter" [Nov.] that yesterday's science-fiction is becoming today's facts and that yesterday's jokes are becoming today's games.

BILL WHITE, Princeton, Fla.

How fast did the car drop?

In "Drop Simulates 62 M.P.H. Crash" [Dec.] in which you showed how the Ohio Highway Patrol simulated a high-speed crash, the speed was given with such apparent accuracy that I went to work with a pencil and slide rule. The results may interest you and the Ohio Highway Patrol.

Initial potential energy—final kinetic energy:

$mgh = \frac{1}{2} mV^2$ final

$gh = V^2 f/2$

$Vf^2 = 2gh$

$Vf^2 = 2 \times 9.8\ m/s^2 \times 125\ ft. \times 1\ meter/3.281\ ft.$

$Vf^2 = 746\ m^2/s^2$

$Vf = 27.3\ m/s$

$Vf = 27.3\ m/s \times \frac{1\ m.p.h.}{0.447\ m/s}$ 61 m.p.h. maximum.

Notice that the falling auto gains its impact kinetic energy by falling a distance of 125 feet minus one car length. Using a conservative car length of 15 feet, we get a height of approximately 110 feet. This yields an impact speed of approximately 57 m.p.h.

STEPHEN MCWILLIAMS, West Lafayette, Ind.

. . . The experiment actually showed what the effect would be of a car traveling at a speed of 61 m.p.h. striking a stationary object, not two vehicles colliding at 62 m.p.h. To accomplish this test, both vehicles would have to be moving at the time of impact. Damage in a collision is a function of the kinetic energy of the moving vehicle. A 4,000-pound car falling 125 feet has a kinetic energy value of 500,000 foot pounds when it strikes the ground. Two 4,000-pound vehicles, each traveling at 62 m.p.h., colliding head-on would have a total

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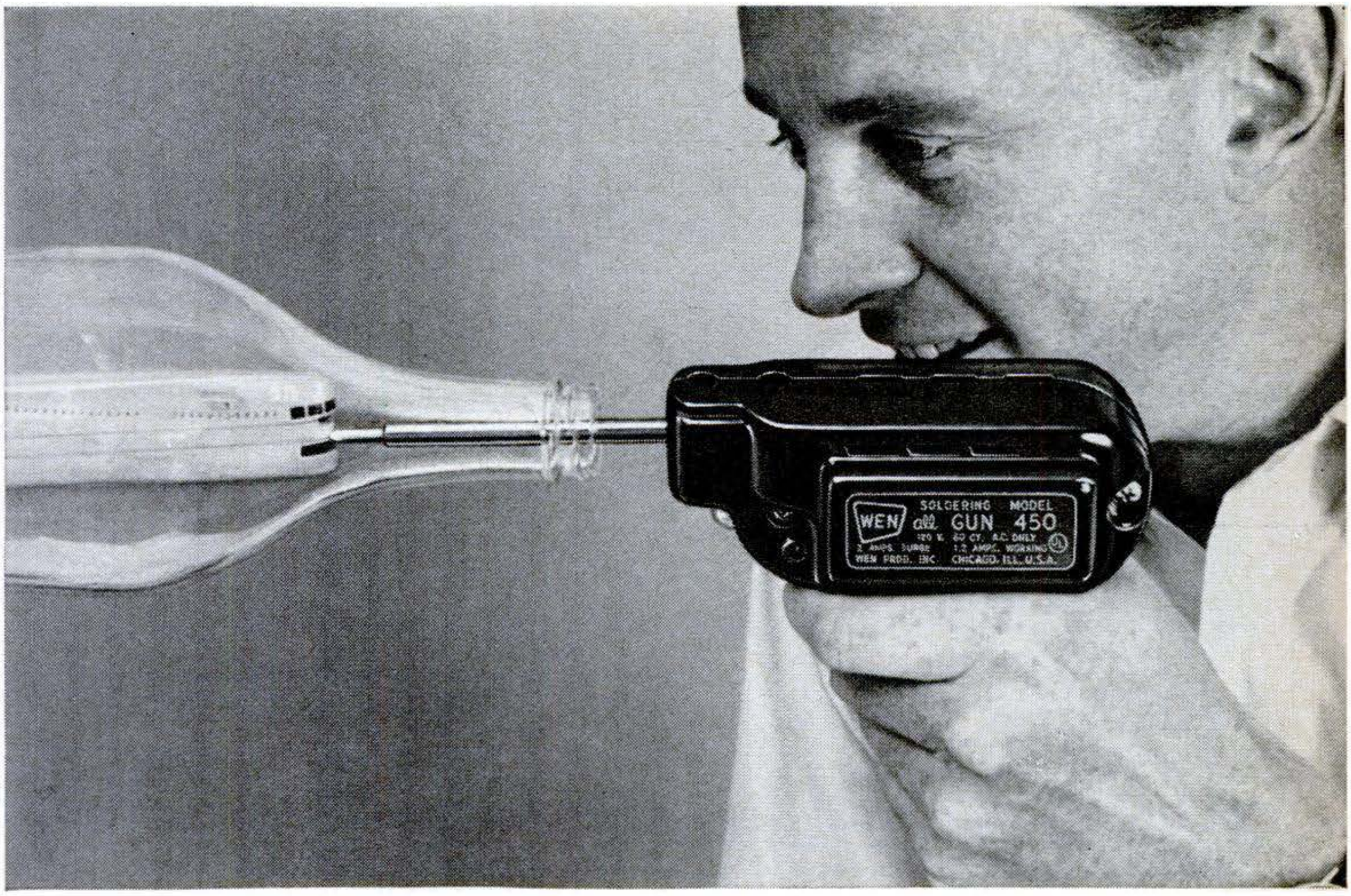
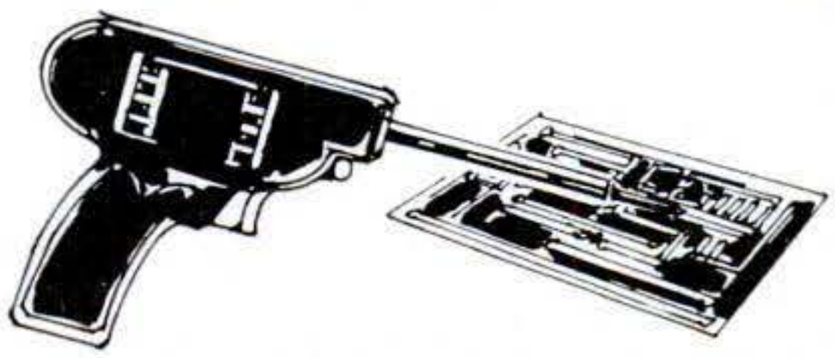
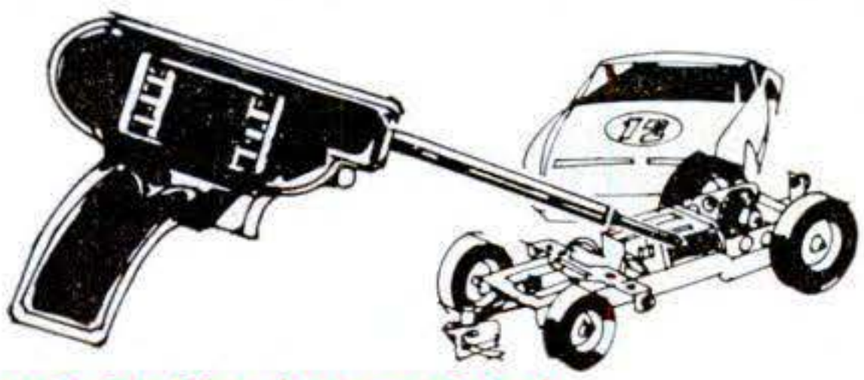


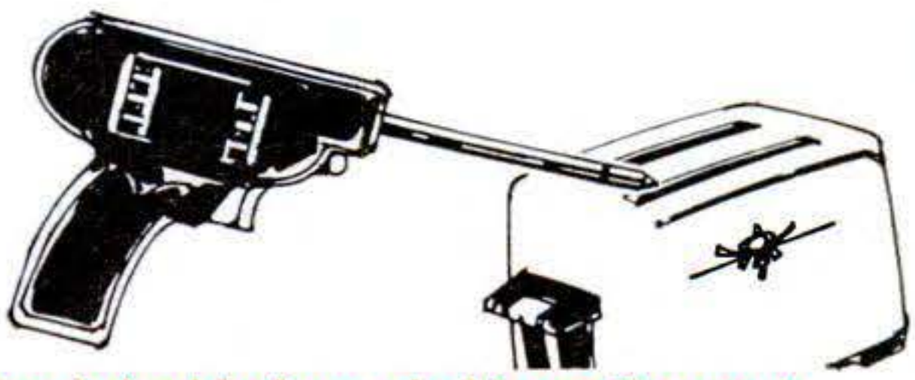
You can reach soldering points with a Wen gun you can't touch with any other!



Reach inside delicate printed circuits!



Reach inside tiny models!



Reach inside household appliances!

The "slim-line" single-post on WEN guns is 45% more compact than those bulky old-fashioned double-posts! It's tailor-made for hard-to-reach jobs! For all its compactness, it's a real fire-ball! For example: WEN's heavy-duty tip generates up to 450 watts of heat power; 125 more than the next hottest gun! And, all WEN tips have a built-in brain that *automatically* controls the flow of heat! Makes every WEN gun "goof-proof!" See WEN's complete line of "automatic" soldering guns; prices start at $4.95. The hottest thing in soldering!

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Model 222 gun. Two tips, two accessory items, solder, case.
$11.95 (suggested list price)

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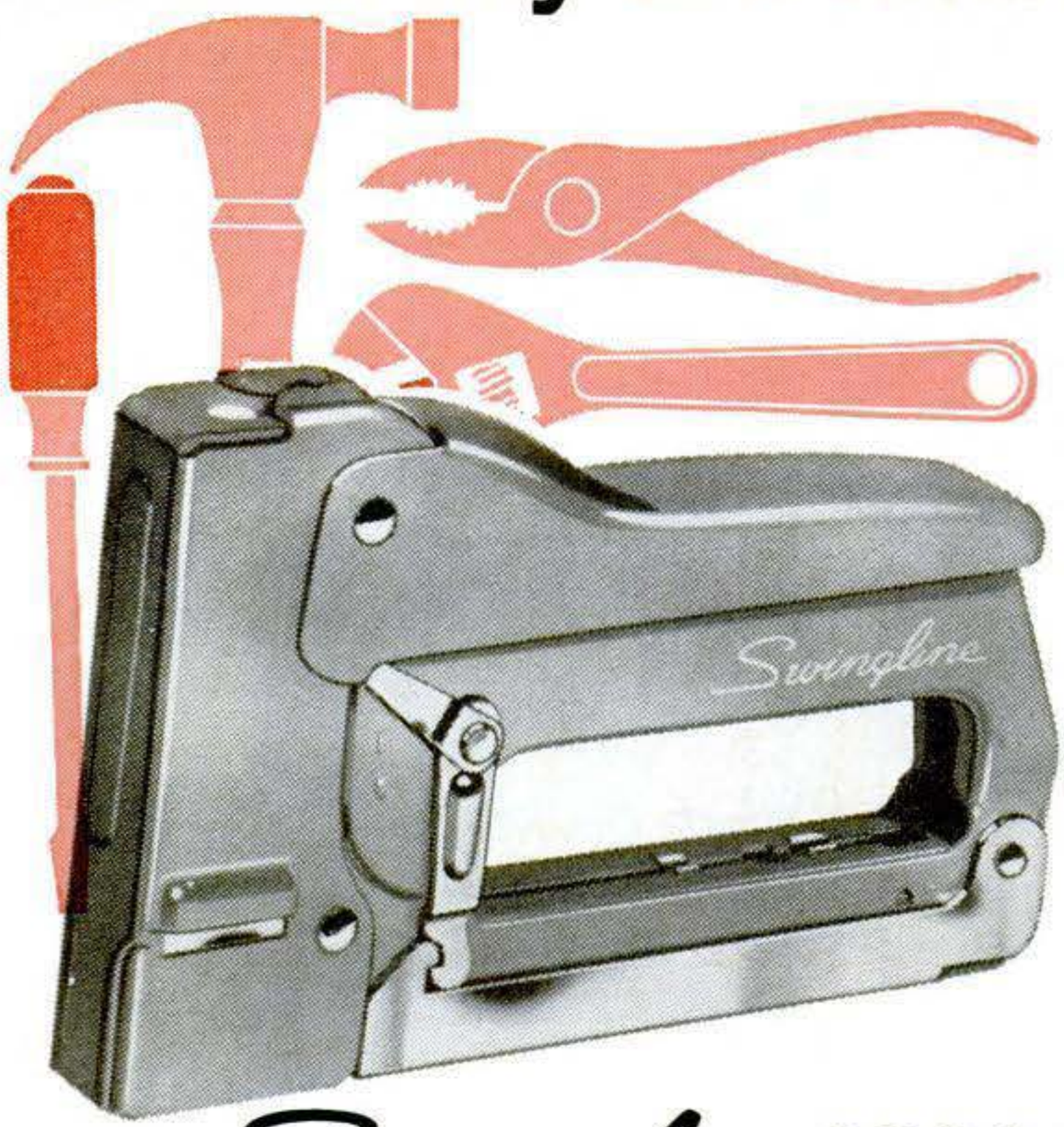

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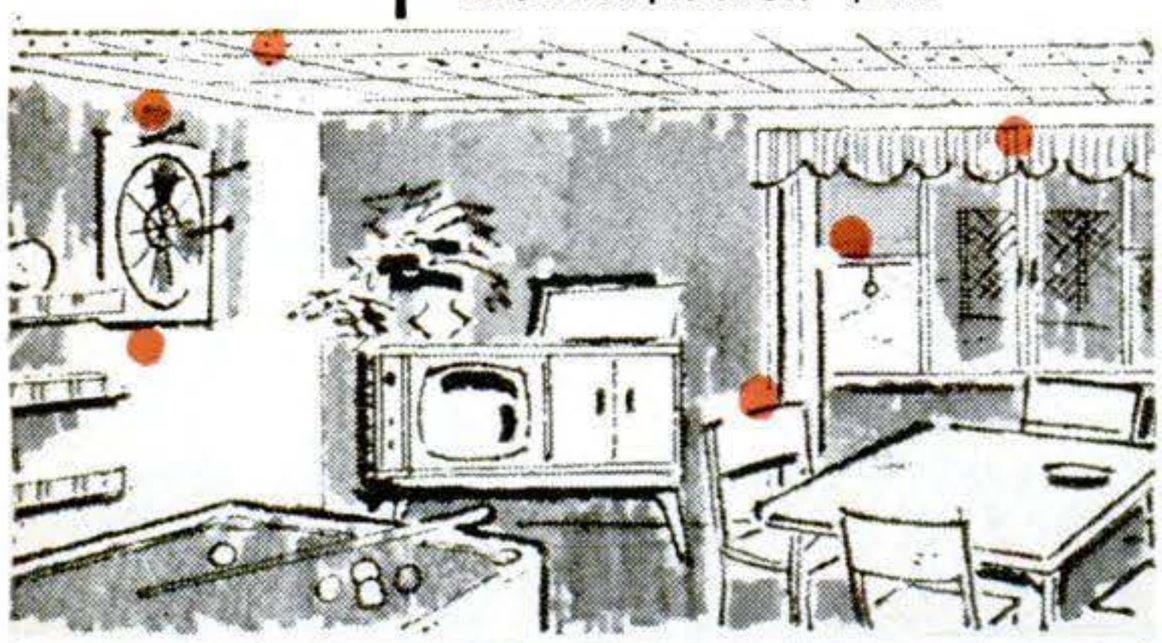

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PS Readers Talk Back
[*Continued*]

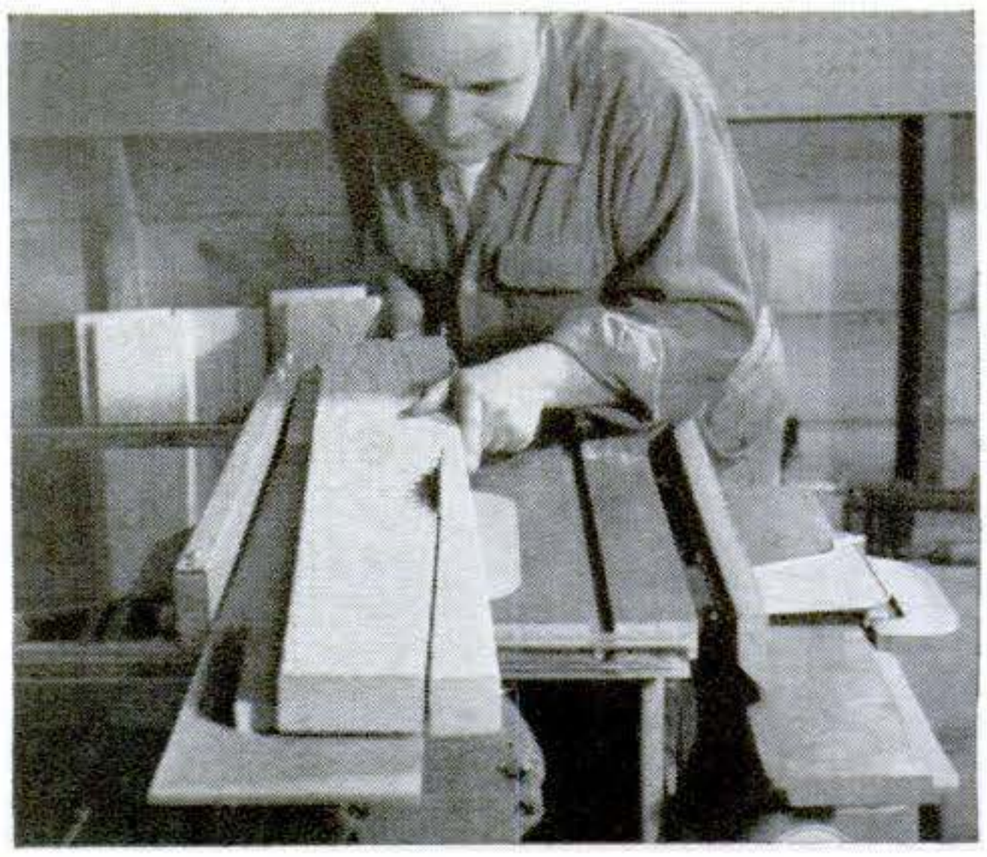
kinetic energy value of 1,000,000 foot pounds capable of causing damage, which will be of considerable difference in each of these situations.

WILLIAM H. TONN JR., Houston, Tex.

Now you figure it out.

Picture causes a shudder

In your article "Split Your Home Shop into Two Parts" [Dec.] there is a picture that causes me to shudder and to lose a modicum of faith in PS. Over the years, I have read with great interest your articles concerning shop safety and I have endeavored to follow them. Yet, here is a picture with two glaring violations of



all that you espouse as shop safety. The man has his hand headed directly toward the whirling saw blade and at a dangerously close possibility of losing his thumb. Where, oh where, is his pusher stick? To make it a little worse and to be sure, he has flopping sleeves. All the better to catch you with Little Red Bloody Hand.

WILLIAM H. LAMKIN, Melbourne, Fla.

It's not as bad as it looks. This old pro is not feeding the board in with his left hand—he's using his right hand to push the lumber while his left hand holds it snug against the fence. Note that he is steadying his left hand on the saw table.

He likes Andretti's reports

For years now, I have enjoyed your magazine and regard it as one of my favorites. I look forward to reading the road tests on new cars, especially in the muscular class. I think PS could do me and many other car lovers a great favor if it would give us more specifications like quarter-mile, and 0-to-60 times. Your writers could probably figure out some kind of chart or graph to serve this purpose. Meanwhile, Mario Andretti is doing a fine job on his reports. Keep them coming.

Continued

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How would you like to be the guy who bought the last car you traded in?

And yours might have been in pretty good shape compared with a lot of them. Most people don't trade a car in until something serious goes wrong.

Of course, used car dealers usually take care of something like that in one way or another. One way is to fix it. That's what Volkswagen dealers do. And you can be sure they do it very well because they guarantee their used cars.

The Volkswagen used car guarantee covers everything that makes the car tick. Engine. Transmission. Rear axle. Front axle assemblies. Brake system. Electrical equipment. For 30 days or 1,000 miles (whichever comes first), a VW dealer will repair or replace anything that goes wrong in any of these areas. At absolutely no cost to you.

You're covered during the period when anything wrong with the car usually shows up. That gives you something important that you don't always get with a used car.

Peace of mind.

We hope that's worth something to you, because it's going to cost you a few dollars more. Not much, considering how much money a VW dealer puts into every car he puts a guarantee sticker on.

The car gets inspected and tested. Then everything that needs fixing gets fixed. Very carefully, since every dealer knows that anything that goes out a little wrong will come back very wrong.

If you're thinking "that's all very nice but I don't want to buy a used Volkswagen," don't go away. To sell a Volkswagen, a VW dealer usually has to buy something else. So he probably has whatever kind of used Something Else you're looking for.

Try him. He might give you a much better buy on a Something Else than a Something Else Dealer.

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PS Readers Talk Back
[*Continued*]

PS couldn't do much better work than it has been doing as far as the rest of the magazine goes, so keep up the good show.

FRANCIS A. MASON, Philadelphia.

The specs you asked for are now a regular feature in the Norbye/Dunne reports (see page 100). And more Andretti reports are on the way. See page 90 for Andretti's test of the Pontiac Firebird.

Ski-scooter fans arise!

Just read your report on snowmobiles "The Wild and Woolly World of Snowmobiles" [Dec.]. I hope you will report tests on new snowmobiles similar to those you now do with automobiles. The manufacture of snowmobiles is becoming big business. I think the public should know more about what they are buying.

MAURICE DAY, Damariscotta, Me.

Remember Pearl Harbor

. . . You goofed in "The Secret Weapons That Hit Pearl Harbor" [Dec.] when you said the battleship Oklahoma was damaged beyond repair. The Navy said in February 1944 that the Oklahoma was back in service.

STEVE ELLIS, Newtown Square, Pa.

The Navy raised the Oklahoma, but did not consider it worthwhile to spend money on putting the 27-year-old battleship back in service. It was sold for junk and sank while being towed to the U.S.

"The Secret Weapons That Hit Pearl Harbor" was very informative about how Japan accomplished the surprise attack. Your detailed map was very helpful in showing the planning the Japanese used.

CHRIS DE CAMP, Claremont, Calif.

What keeps the whiskers in suspension?

In "The Amazing Windowpane That Goes from Light to Dark" [Nov.], how come those whiskers of metal don't just sink to the bottom in a heap in the liquid that holds the dipoles in suspension? No matter how small (one micron) the whiskers may be, their density is still much greater than any liquid, isn't it?

ANDREW VENA, Philadelphia, Pa.

Brownian movement, a rapid movement of microscopic particles suspended in a fluid, is the reason.

Electric autos on the way

Thank you for "Electric Autos . . . They're on the Way" [Dec.]. I thought it was very interesting and informative.

C. BROWN, Claremont, Calif.

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TOM McCAHILL SAYS:

"There's COLD CASH In Repairing These Things!"

Each time a buddy of mine moans about the lousy repair job he got on his refrigerator or toaster or washing machine, I'm reminded of the fact that a good Appliance repairman is a mighty rare breed these days.

This neighbor of mine had refrigerator trouble just last month, and needed some speedy repair service. After phoning half a dozen repairmen who were booked solid for days, he finally had to settle for a bum job from a guy who had no business calling himself an Appliance repairman. This brings me to an important point. No one who wants to earn money in Appliance repair needs to learn by trial and error. There's a great, low-cost home study plan on the market that covers every type of Appliance repair in detail. The course was prepared by the Appliance Division of the National Radio Institute, one of the biggest and best schools in the field. Thousands of guys like yourself have studied with NRI, and many of them have more than paid for the low tuition fee within their first couple months servicing Electric Appliances.

If you want to make money (and who doesn't) in a field that's crying for good talent, make certain you send for a free NRI catalog. Get the details on the well-illustrated lessons that teach you how to repair home, farm and commercial Appliances, and small gasoline engines. You'll be amazed at how little the training costs. And you'll even get a professional Appliance Tester without extra cost.

NRI has been in the home study field since 1914, and they have a staff of 150 experts in Washington, D.C., who guide you through the course with more personal attention than you'd fine in some classrooms. If you're really out to learn, they can furnish a special course in air-conditioning and refrigeration repair, too.

Even if you've never tried to put a toaster in working order, even if your schooling never went beyond the tenth grade, I'm as certain as my name is McCahill that you can make money in the Appliance repair field with the help of this NRI course.

Do yourself a favor right now. Send off the coupon below and NRI will send you a free catalog. If you don't like the looks of this material, you can forget the entire deal, and you'll be out only one postage stamp. But remember, the Appliance repair field needs qualified men *now*. And you can qualify with NRI training.

Tom McCahill

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"Say, Smokey—"

A clinic on cars by America's most famous mechanic

Each month in POPULAR SCIENCE Smokey Yunick answers questions on cars—family cars, high-performance jobs, hot rods, and racing cars—selected from those sent in by readers. Got a problem? Ask Smokey. You'll find the address at the end of the column. Please *print* your name and address.

Smokey (right) watches race with veteran-drivers Curtis Turner and Rodger Ward.

"The clutch on my '64 Pontiac GTO went out recently, and I had it replaced with a new heavy-duty clutch and pressure plate. It is now hard to depress and it slips slightly on hard shifts. Will it eventually wear in, or are these symptoms normal?"

JOHN SIVEN, Newtown, Conn.

The hard pedal effort may be caused by a pressure plate built by a replacement-parts company that is not just right for the linkage. The slipping is not good. Assuming the adjustment is okay, and there is no oil or grease on the parts, the clutch should get better when it seats in. It should hold everything as installed—unless you're doing some dragging.

"My '63 Corvair constantly has an oily film covering the engine. I clean it off, but it gets covered again after a drive. There are no visible oil or fuel leaks."

LANCE MASTROV, Brooklyn, N.Y.

The problem is simply a bunch of loose nuts and bolts. Pull the upper shrouds and dig down into that engine. Check all engine covers, bad gaskets, and loose bolts. Use Loc Tite as you snug up.

"I am considering ordering full transistor ignition on a Pontiac. What is your opinion of it? How will it affect performance and economy? How about servicing and the life of the unit?"

RALPH A. ABANDAND, Garnerville, N.Y.

It works well and doesn't give much trouble—but when trouble occurs, it's hard to find. I see no possibility of increased mileage or performance unless you're going to run at speeds that require an engine r.p.m. of over 6,000. Properly installed, transistorized ignition should last for the life of the car. It will start the engine better in cold and damp weather. It is also very good at messing up TV reception.

"Every time I start up from a stop in my 1963 Comet with 170-cubic-inch, six-cylinder engine, I have to baby the throttle, or it stalls. I've talked with servicemen, and have had a Mercury dealer work on it to no avail."

ROY O. GRAY, Oakland, Calif.

You need a good carb man who can get you the right fuel-air mixture when you open the throttle. Here's what's happening: When you accelerate, the flow velocity goes down in the carburetor, causing a fuel shortage. The accelerator pump is supposed to cover that flat spot, but if the carb venturi is too big, and the gear ratio too high, an engine just spits and quits. This kind of trouble can also be caused by late ignition and cam timing. Other things could be involved, too. I'd start attacking the problem with a tune-up.

"I want air conditioning on my next car. Will a 145-hp. six handle it, as well as an automatic drive, or should I get an eight as the salesman says? Is the $400 factory A/C worth $150 more than the $250 kind you can buy and get installed after purchase of the car? The salesman says I need a heavy-duty battery, radiator, tinted glass, and such—so the factory deal is best. I'm unconvinced."

FRANK JETER JR., Falls Church, Va.

The small engine will pull your A/C and automatic but not with the performance people are demanding today. So better get an eight. Even if you're willing to put up with the reduced performance, the law of economics will catch up with you at trade-in. I believe the factory-installed unit is better (if you're buying a new car) for mechanical cleanliness, efficiency, and warranty. You need a heavy-duty battery and radiator, but I don't dig the advantages of tinted glass. This, I imagine, is meant to keep the car cooler, but you can forget it.

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AC announces a breakthrough that virtually eliminates wear in your car engine...

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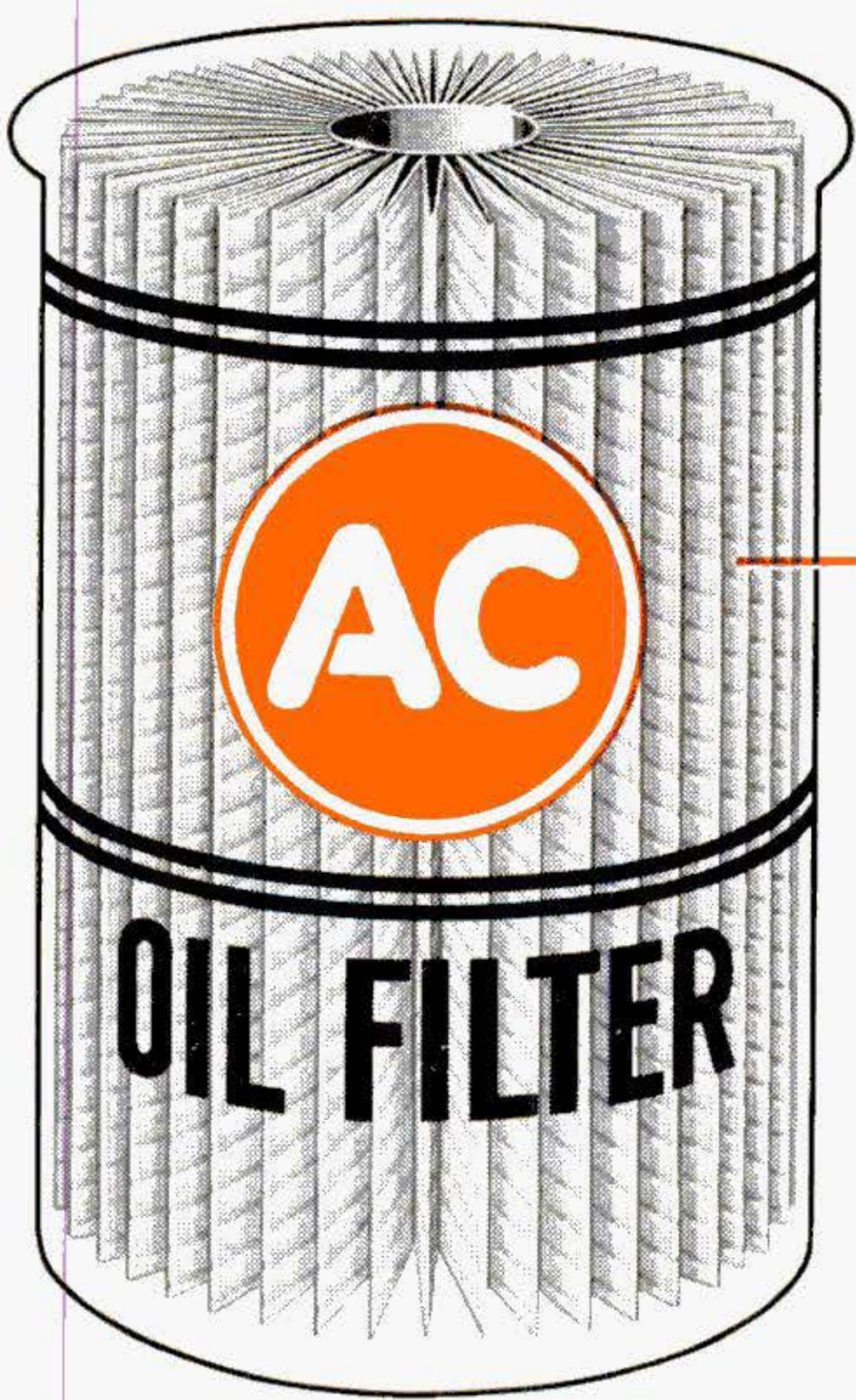

AC's new Oil Filter with ACron — a special heat-resistant composition, proved in grueling road and laboratory tests. ACron virtually eliminates engine wear, even under the most severe operating conditions.

AC now offers new ACron to the motoring public. ACron is a special filtering material, proved in the laboratory and in actual road tests to be the best protection available for modern engines using full-flow filtration. ACron virtually eliminates engine wear.* It traps all harmful engine contaminants while letting through additives that clean and lubricate vital engine parts. AC Oil Filters with ACron are original equipment on new General Motors cars. They meet or exceed the warranty requirements of all car manufacturers. Insist on AC Oil Filter protection the next time you change. *It costs no more to get the best.*

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*When oil filter is replaced and other engine maintenance services are performed in accordance with car manufacturer's recommendations.

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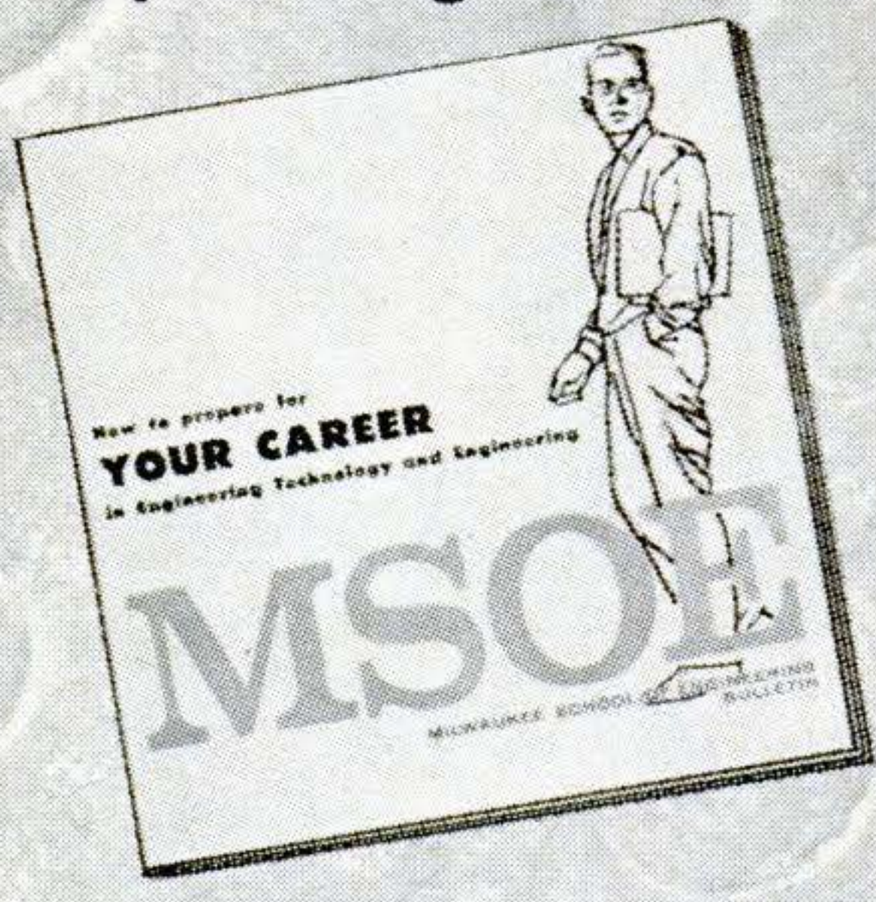

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"Say, Smokey—"

[*Continued*]

"I recently purchased a car with a set of Halibrand magnesium wheels. What are their advantages, disadvantages, and the reason for them?"

A. TURCOTTE, Dundas, Ont.

Magnesium wheels are okay for race cars, and for looks on street jobs, but in my opinion it ends right there. Corrosion can cause a maintenance problem. Magnesium wheels do reduce unsprung weight, but hardly enough to be noticeable. Halibrand Engineering originally designed them for Indy racers, and they helped quite a bit there because wheel weight is bigger in relation to total car weight. If you're a bug on looks, they're racy.

"My 1966 Chrysler 300 has some sort of a lash in the rear end. At 30 m.p.h. it's irksome to hear it clicking every time I press the accelerator or let up on it. My dealer says it won't harm the car, and won't do anything about it. If it can, and should, be fixed, please tell me how to get it done."

ELDRED H. DAIGER, Montrose, Va.

If I could take that noise out of all the Chrysler cars that I've been asked to, I'd be a millionaire. It can't be done at reasonable expense. You're dealer is right—it won't hurt anything. I'm sure Chrysler is working on a fix. Keep in touch with your dealer.

"My 1965 Pontiac wagon with heavy-duty suspension ran perfectly for 6,000 miles. Then all of a sudden the alignment went out. Nothing that the dealer, or any other garage, has done will straighten it out. It wanders all over the road. A friend has the same trouble, so I wonder if it is in the nature of the '65 Pontiacs."

H. T. ELMS, Geraldton, Ont.

Don't fool around with that thing! This is not standard behavior for that model, and sounds dangerous. Have your dealer call in the Pontiac zone service manager to check it out. The cause could be a bad shock, or a loose, bent, or broken suspension part—front or rear.

"My gas mileage on my '64 Chevelle 283-inch engine, with automatic transmission, power steering, and air conditioning, is 13.5 to 14 miles per gallon around town, and about the same at 60 to 70 m.p.h. It was put on the Sun machine, and has had new points, distributor rotor, condenser, and plugs. The compression checked okay. How do I get better mileage?"

S. J. RICHARDS, Birmingham, Ala.

Check to see whether a too-low axle ratio is at fault. Have the timing road-set to maximum. Be sure the float level is at minimum. Keep the tires well up. Have the transmission shift points checked to specs. Be sure the choke adjustment

Continued

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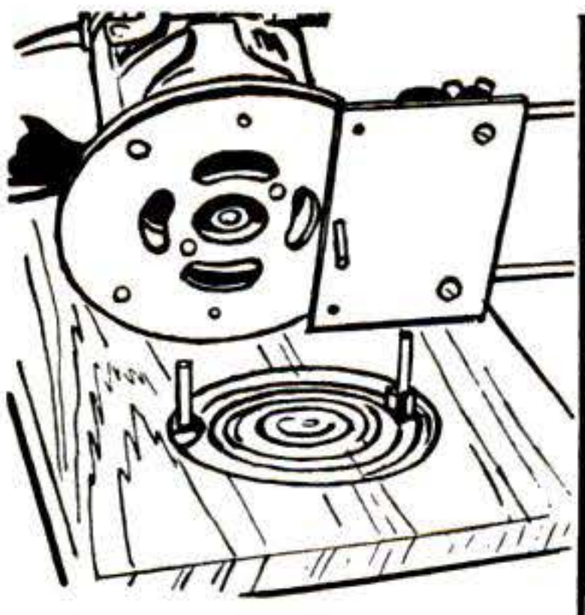
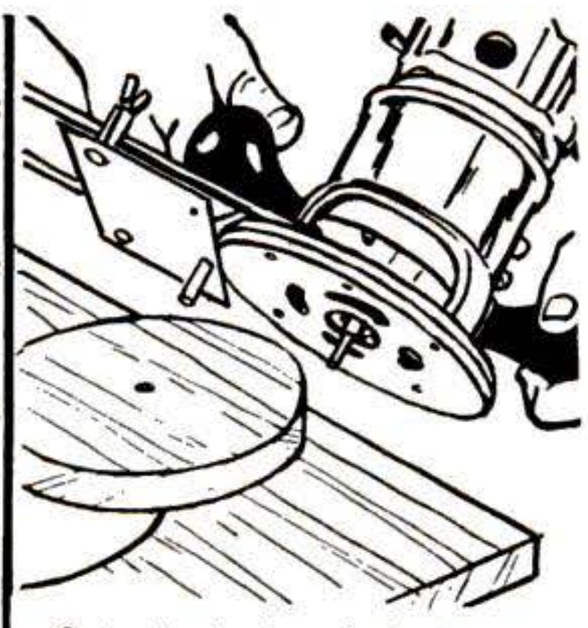
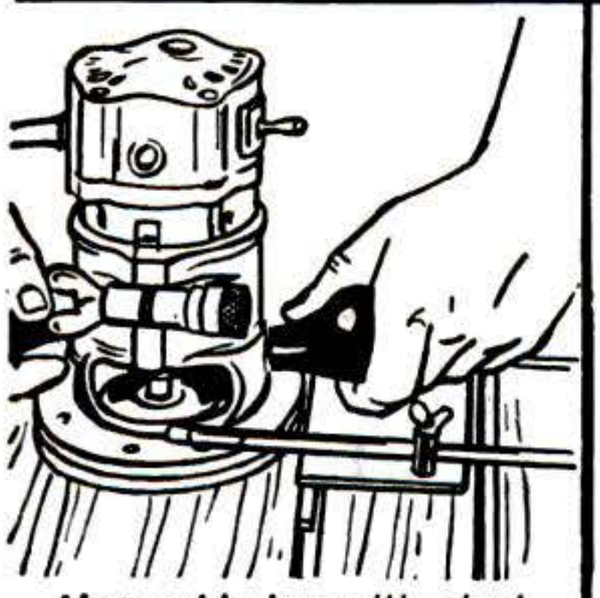


For unique circle designs swing router on pivot pin with bit cutting shallow. Combine bits for rosettes.



Set pivot pin of circle guide in pre-drilled ¼" hole, move router counterclockwise to cut wheels, disks.



Use guide bar with pivot pin removed, or simple T-square made of scrap, to cut decorative grooves and slots.

For rabbets or decorative cuts in straight edges, move router with straight guide pressed firmly against work.

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B·D

"Say, Smokey—"

[*Continued*]

is dead right. Have the front end checked for alignment and track, to be sure you're not using fuel to scrub rubber. Make certain the brakes aren't dragging. Finally, drive as if you had an egg between your foot and the accelerator. Mileage should then come up three to four more miles per gallon.

"My 1965 Plymouth Belvedere came from the factory with 7.75-by-14 tires. How much bigger can I go in tire size—as much as 8.25-by-14 using the same rims? Is it a good idea to switch?"

SAMUEL SPECTOR, Mobile, Ala.

You should use an 8.25-by-14 at least on a 5½-inch rim. But there are other things to watch out for in changing tire sizes. The speedometer gear ratio must be changed accordingly to give you the true speed and mileage readings. It should help mileage a little, but at the cost of power. Handling should be a little better.

"My '64 Ford Galaxie with 289-inch engine was always quite good on oil, but now, at 23,000 miles, has begun to use it at the rate of a quart per 200 miles. The Ford service manager, without looking at the car, says I need new valve seals. There is no sign of plug fouling, though it smokes a little when starting hot. Is the manager right?"

JON B. LEDER, Brooklyn, N.Y.

Probably. But a check on a Sun cylinder tester would have to prove that out. If the blow-by at the rings is normal, and there are no external leaks, usually the valve seals have had it. Replace the seals with Perfect Circles, and I don't believe you'll be plagued with that trouble again.

"The gears in my '65 Corvair Monza with four-speed manual transmission tend to jam. It's mostly in first and second gear. I have to struggle to shift into first. Second is hard. Third and fourth, when rolling, go in with a slight jar. The synchronizing mechanism was changed once, with no improvement, and the dealer can do nothing about it."

MONAS SEIDMAN, Brooklyn, N.Y.

A good linkage adjustment will often remedy your kind of transmission trouble. The trouble could be in the transmission cover (detent system and forks). If everything is okay in cover and linkage system, pull the transmission. Have it checked for sticky splines and too much play in the shafts, though it could still be synchromesh trouble that you're having.

Got a question on autos? Send it to:
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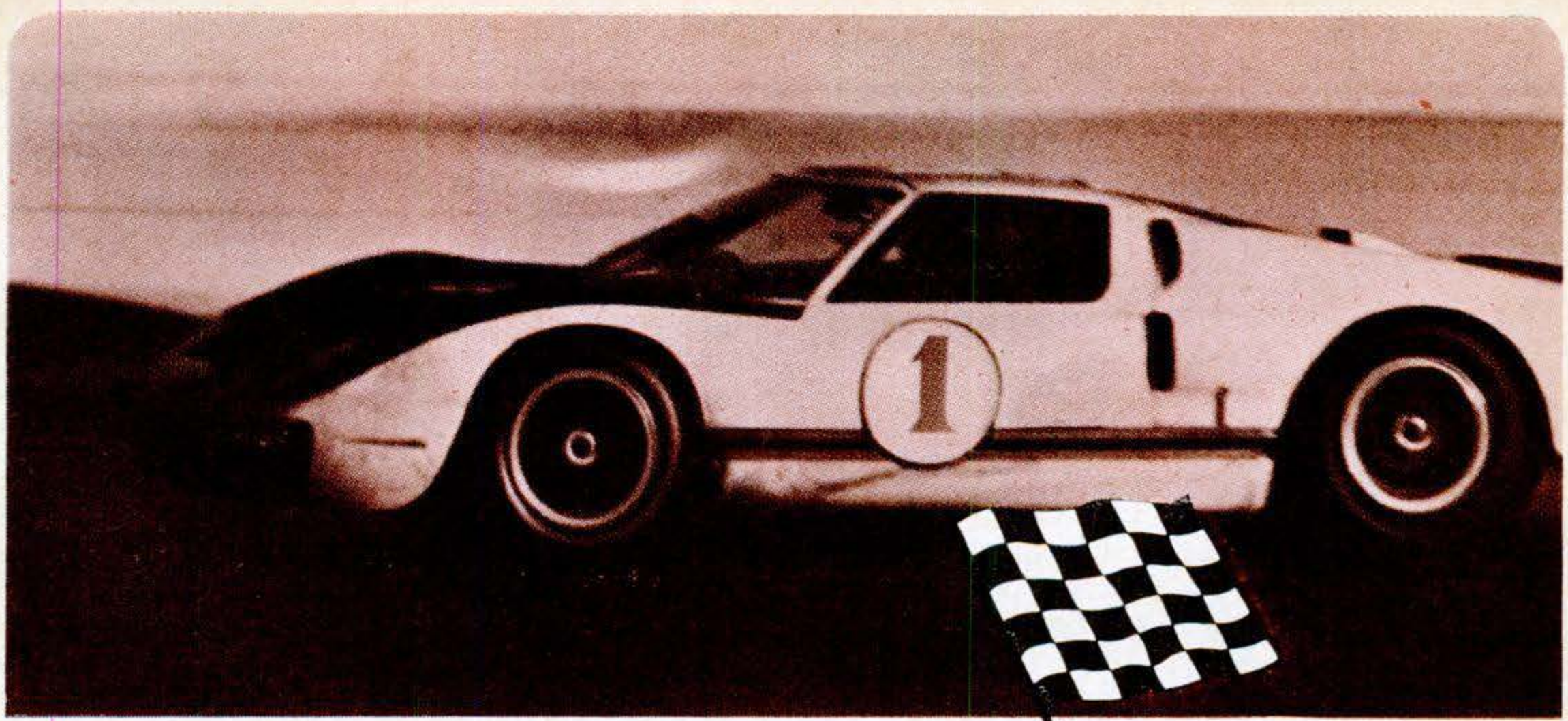

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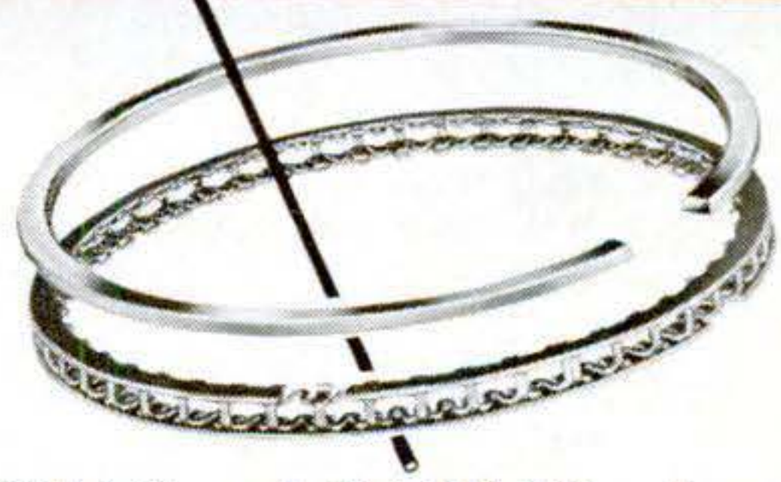

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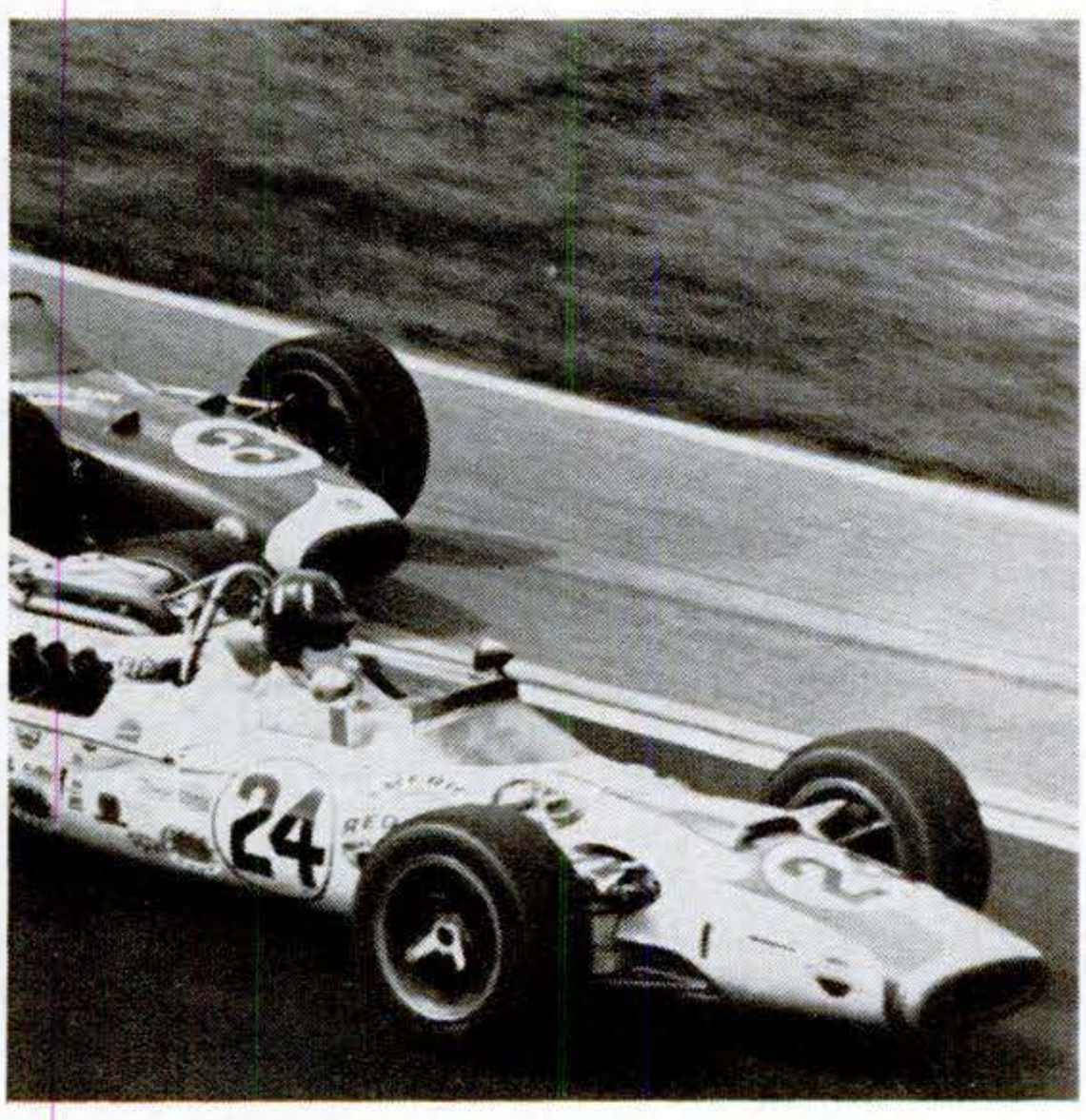

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Science Newsfront

Last-minute news and notes to keep you up-to-date

By W. STEVENSON BACON

Bus to travel road or rail

If you use buses or trains regularly, you may be in for a shock. Some morning, you'll see a bus pulling up to your station on the railroad tracks or, conversely, be aboard a bus that pulls off the street, climbs onto the rails, and becomes a "train." Such is the plan of the Port of New York Authority, the New Jersey-New York transportation agency, which is currently sponsoring work to develop a passenger bus with retractable rail wheels. The buses would be able to avoid traffic jams and could provide versatile road-and-rail commuter service.

Lasers for blasting highway tunnels?

The development of laser "blasters"—thought to be strictly science fiction—may be practical after all. In experiments at MIT, Robert A. Gladstone and Anthony Kettaneh demonstrated that hard rock can, indeed, be crumbled with a laser beam and that laser boring machines may create the highway, railroad, and water tunnels of the future. Using an extremely powerful one-kilowatt carbon dioxide gas laser, the students found that the beam caused microscopic cracks to appear in rock within three to five seconds; after 30 seconds, the rocks lost their strength and fell to pieces when picked up. The effect of the laser beam seems to be due to rapid, local heating of the rock.

Elastic water climbs out of pitcher

Weird as it sounds, water that climbs uphill over the edge of a pitcher and whose flow can be stopped by cutting it with scissors has been accidentally discovered by David James of the California Institute of Technology. The water —almost 100-percent pure—has one added ingredient: a tiny amount of polyethylene oxide, a polymer used in paints and women's hair sprays. It gives the water elastic qualities, probably because of its long, threadlike molecules. The liquid spilled out of the pitcher keeps pulling more liquid out, and the flow forms what might be called a tubeless siphon. When the flow is cut an inch or two below the container rim, the elastic water snaps back into the pitcher.

Artificial arm controlled by thinking

An artificial arm that can be controlled by conscious thought, yet requires only a "cigarette-pack" computer to guide it, has been developed by Temple University Medical Center and the Philco Electronic Engineering Laboratories. So flexible is the device—now in the developmental stage—that it will ultimately do almost everything a human arm can do. As shown in the photograph, electrodes attached to the stump of the arm pick up nerve im-

pulses resulting from conscious thought and channel them into the miniature computer which coordinates arm motions.

Automatic highway proposed

Now is the time to build a prototype "Century Expressway" for 100-m.p.h. travel ["How Fast Will We Drive," PS, Oct., '65], according to Robert A. Wolf, of Cornell Aeronautical Laboratory, who spoke at a recent meeting of the American Institute of Aeronautics and Astronautics. The highway—the first designed for safety at 100 or above—would also serve for the first application of automatic electronic steering to cars. An even more advanced automated system described by Wolf would make use of electrical cars driven by batteries on local streets and powered by automatic guide rails on high speed "railroads." Known as the Urbmobile System, the new transit system would combine the flexibility of door-to-door transit with the high capacity and unimpeded speed of rail travel. Cornell is making a study of transit schemes for the U.S. Department of Commerce.

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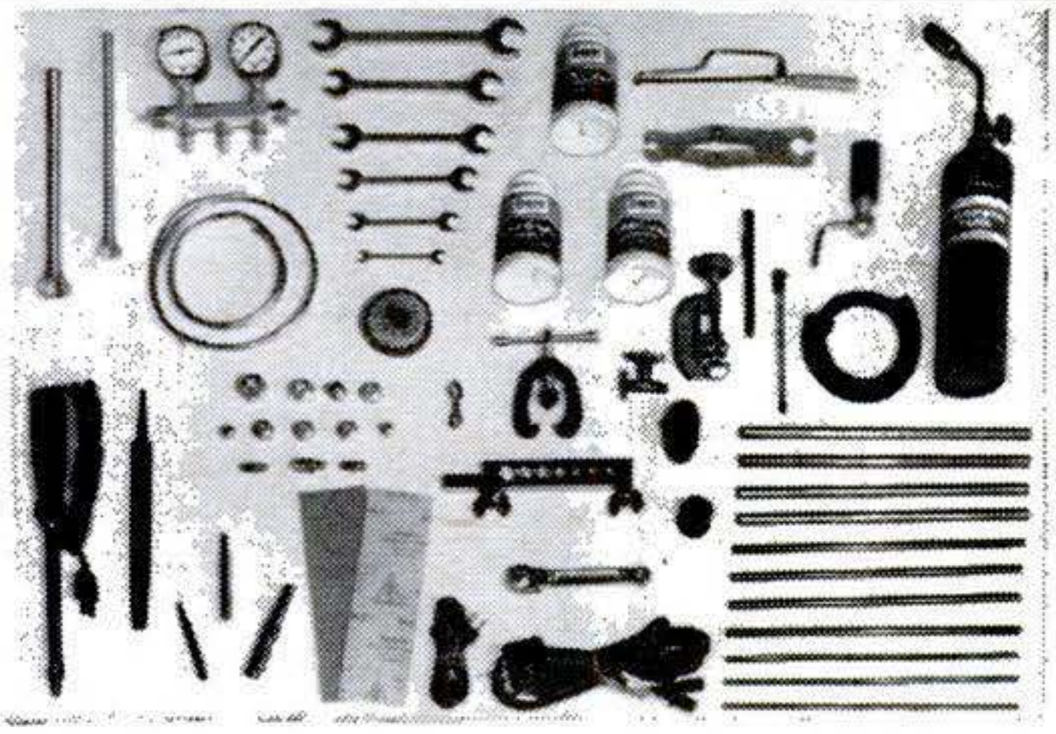

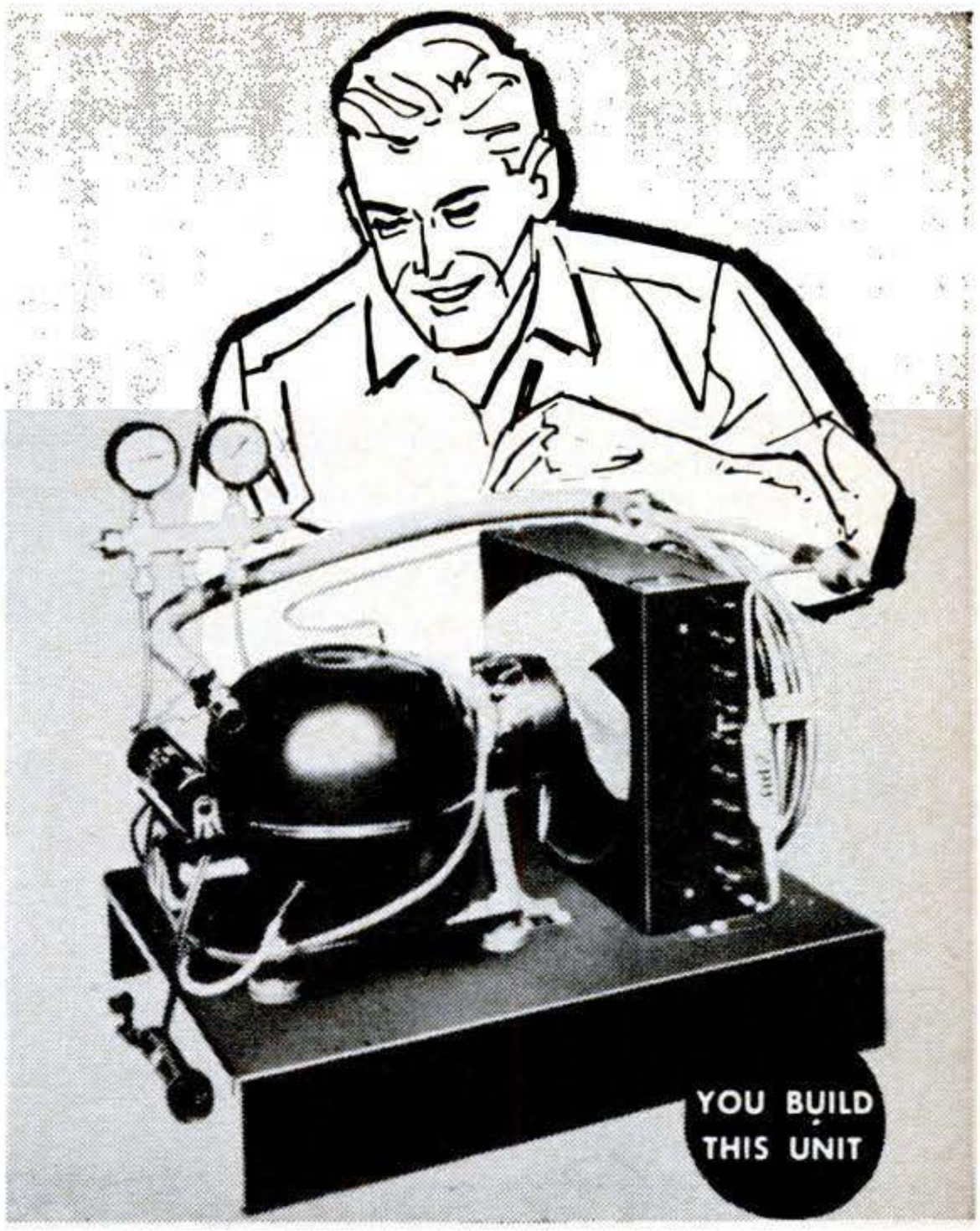

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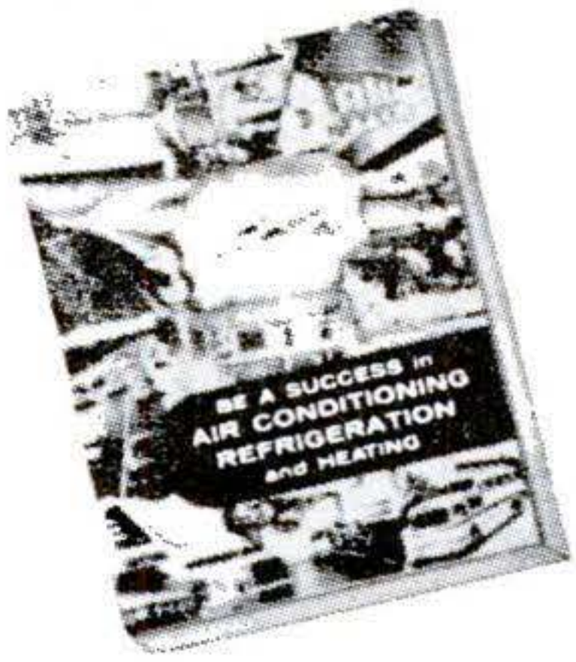

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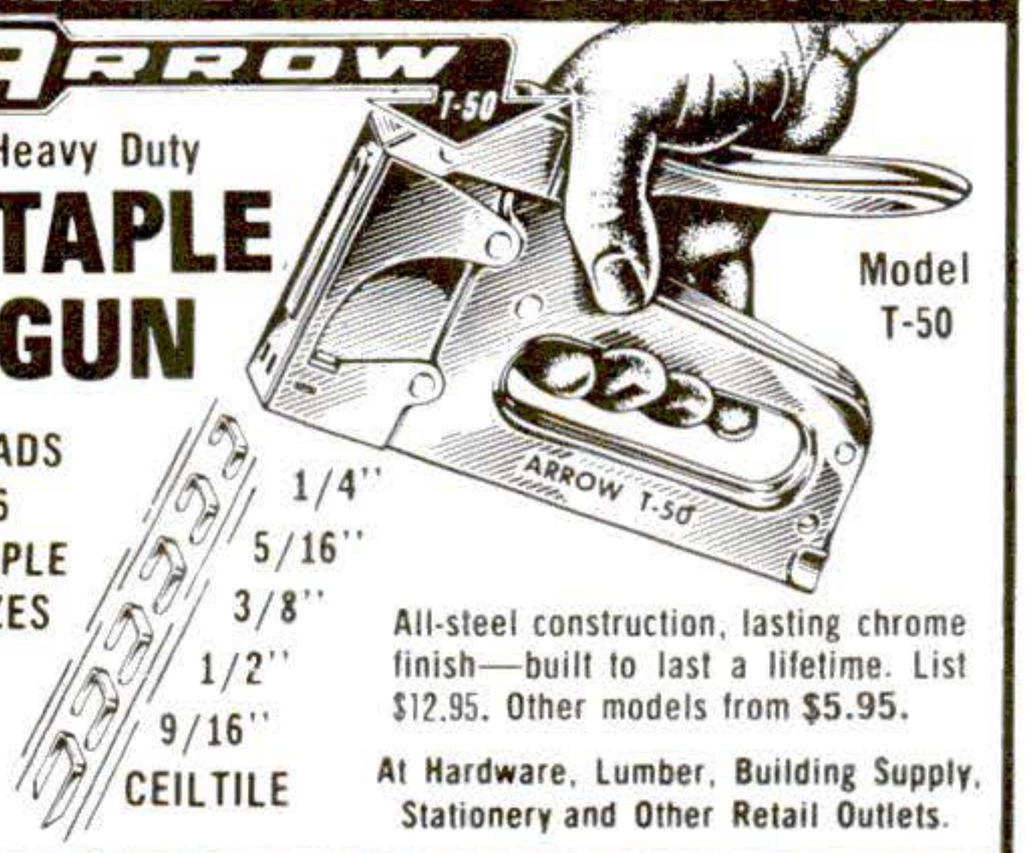

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Science Newsfront
[*Continued*]

"Brain-wave football helmet" aids research

Northwestern University halfback Woody Campbell has the distinction of being the only man ever to play football with electrodes glued to his head and wearing a "brain-wave helmet." Since offensive halfbacks take the worst beating during a game, Campbell was chosen to wear headgear with EEG (electroencephalographic) equipment and a radio transmitter installed in it. The purpose of the equipment? Not to transmit information from the coach but to find out how well the helmet—ordinary in all other respects—protected Campbell.

Apples grow like grapes

The apple orchard of the future will consist of dwarf trees supported by mechanical trellises that automatically harvest the fruit. Dwarf trees can be easily trained on wires and pruned into ground-level "tree walls" according to scientists at Pennsylvania State University. The wires supporting the trees can then be mechanically vibrated to cause the apples to fall off at harvest time. The advantages, already demonstrated by experimental "tree walls," are many: high-grade fruit due to good sun exposure, good spray coverage, a large crop a short time after planting, and less than half the cost of a conventional orchard.

Rocket illuminator lights two square miles

A new concept in spotlights, a rocket flame that will illuminate two square miles of battlefield from an aircraft a mile high, is being developed for Air Force use in Vietnam. Basically, the battlefield illuminator consists of equipment to feed pressurized jet fuel and liquid oxygen, with a small amount of sodium to improve visible radiation, to a hollow quartz tube. Burning fantastically hot—5,300 degrees F.—the exhaust gases give off a brilliant light which is focused downward by a parabolic reflector. The lighting system, being developed by Astrosystems International, is claimed to produce 50 times greater brightness than full moonlight at one-tenth the cost of flares.

TV walkie-talkies now possible

A tiny tubeless TV camera about the size of a conventional 35mm camera may make possible two-way TV walkie-talkies. The revolutionary device, which can transmit good-quality pictures to a television screen from any location using battery power, makes use of an entirely new principle. Light from a lens is focused on a one-inch-square glass plate covered with 32,400 microscopic dots of photoconductive material arranged on a metal grid. Along two of the four edges of this image-sensing plate are attached two other plates on which have been deposited hundreds of thin-

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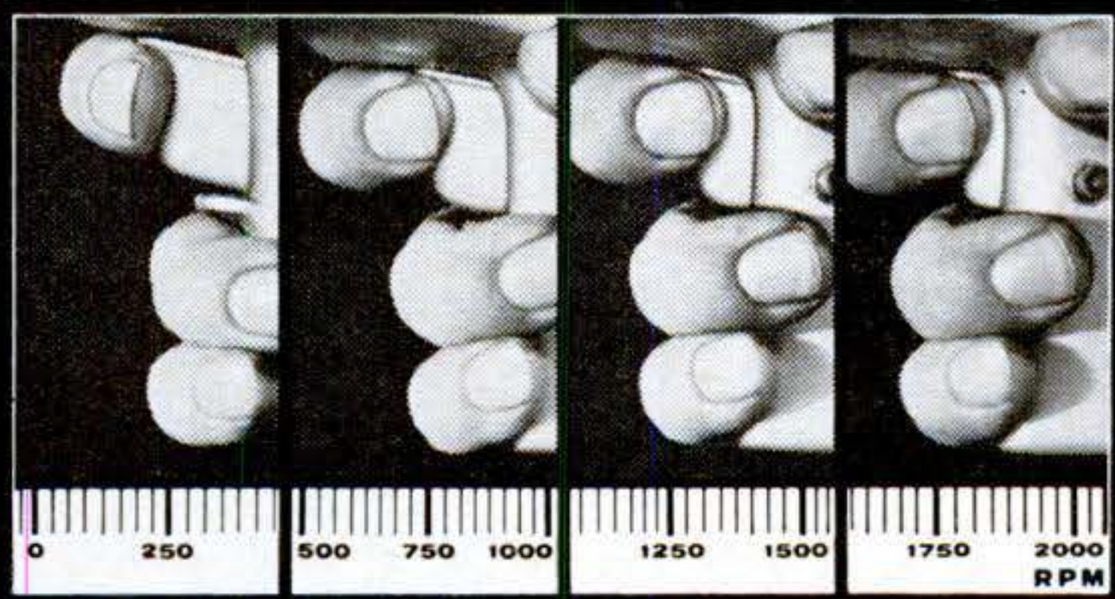

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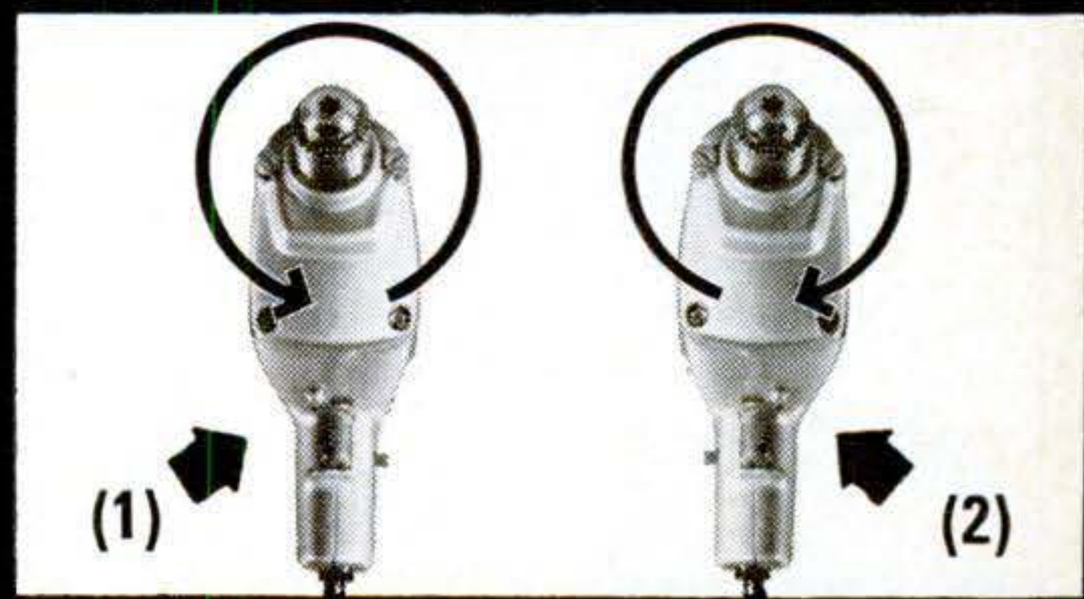

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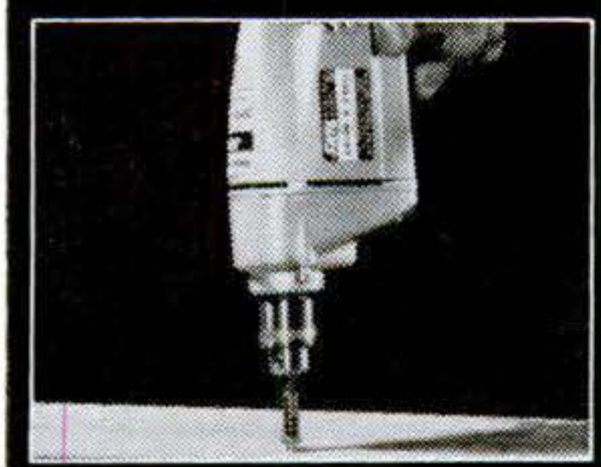

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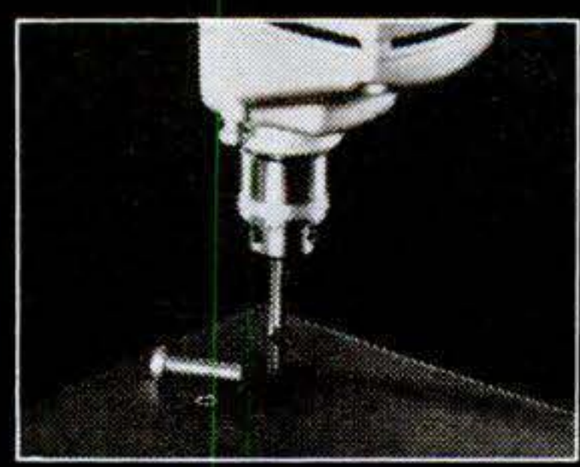

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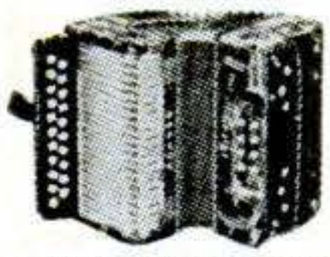

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film transistors and other parts; one group connects to the horizontal grid lines and the other to the vertical. By scanning the vertical lines and horizontal lines simultaneously, the pattern of conductivity of the dots—as they respond to light—can be changed into currents from which a picture can be recreated. The tiny camera was developed by RCA for the Air Force under the direction of Dr. Paul K. Weimer.

How to put a library in a shoe box

All of the books in your local library—plus a good many more—can now be stored in a small file about the size of a shoebox. How? By using an information storage system recently unveiled by the National Cash Register Co. It puts up to 3,200 images of book pages or documents on one four-by-six-inch piece of film. The secret of the new process is a master plate made by coating glass with photochromic dye, which darkens in response to light of a certain color and which can be erased with yellow light. The dye has no "grain" as has the silver halide used in ordinary film, and the limit of its resolving power is the size of its molecules. This fact permits 150X reduction. After a perfect master has been recorded, inexpensive microfilm copies—each equivalent to 16 200-page books—can be produced.

How much can you drink and what?

What makes you drunker, bourbon or vodka? The answer is bourbon, according to Dr. Edward S. Katkin and Dr. William N. Hayes of the State University of New York who are conducting a serious study into the aftereffects of drinking and how they may affect the performance of drivers and others called upon to solve problems. While researchers stress that no alcoholic drink can be considered "safe," they point out that bourbon is relatively long-lasting. Reason: It contains chemical substances other than ethyl alcohol, called "congeners," that cause its effects to linger in the body. The effects of vodka, which is closer to pure alcohol, are easier to shake off.

When is a glass arm a baseball elbow?

The wild and wonderful words used to describe sports injuries—charleyhorse, cauliflower ear, glass arm, and tennis leg—are now respectable parts of the English language. The American Medical Association's new SNAI dictionary (for "Standard Nomenclature of Athletic Injuries") lists 1,100 of them with medically precise definitions. Purpose of the dictionary is to eliminate confusion; the terms often mean different things to different people. A cauliflower ear is an "ear, hematoma, acute," for example, while a charleyhorse is a "quadriceps contusion." PS

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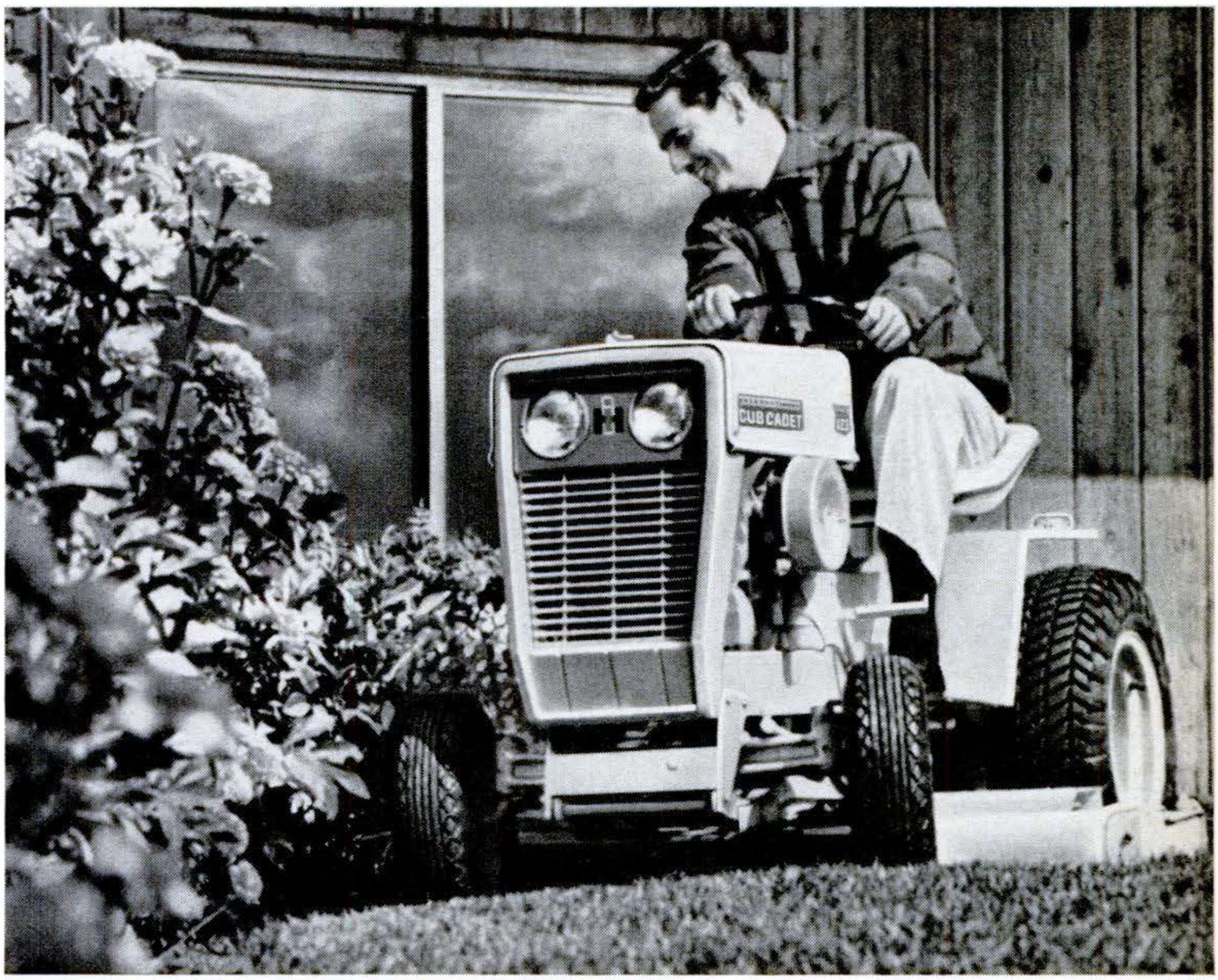

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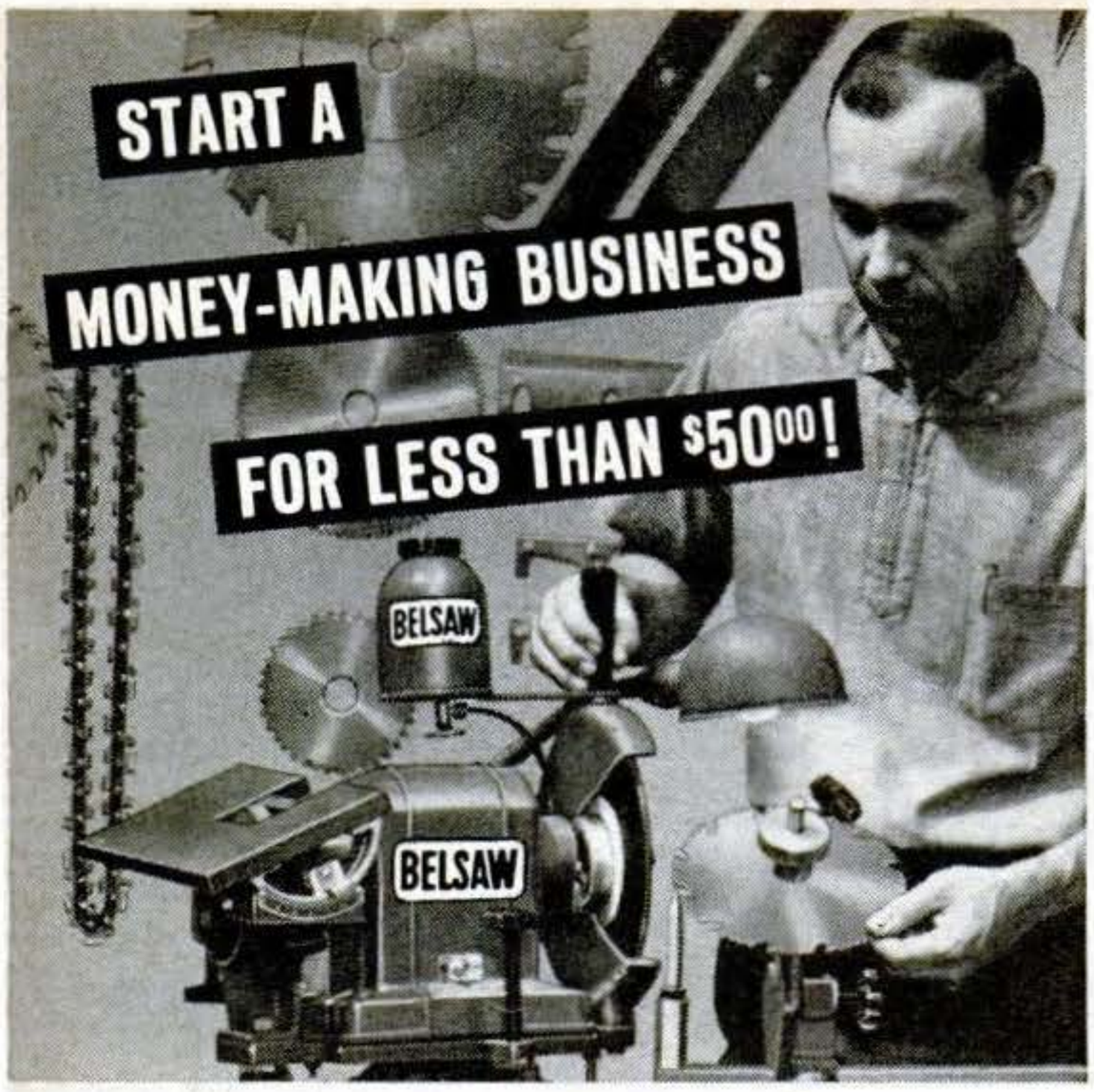

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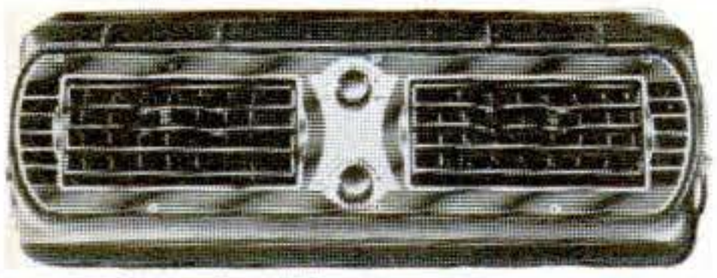

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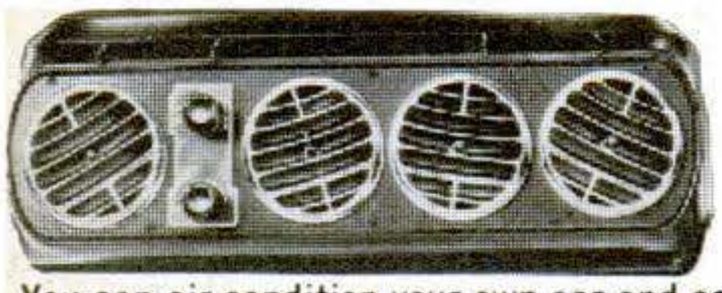

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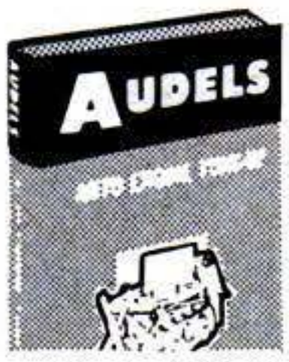

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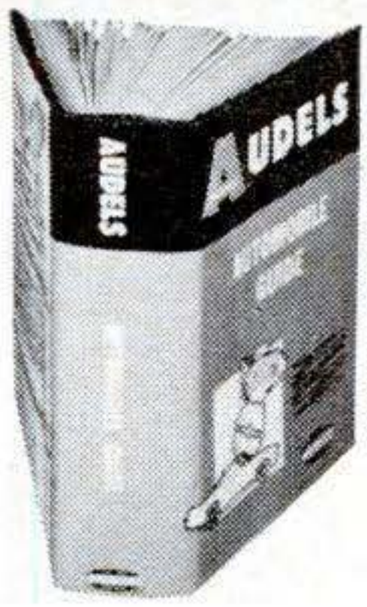

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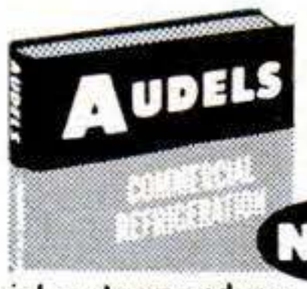

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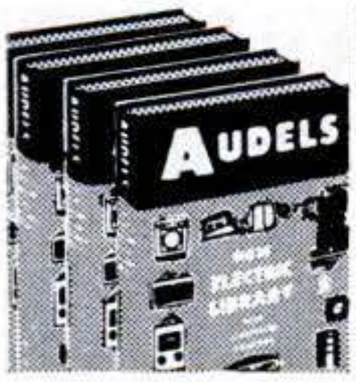

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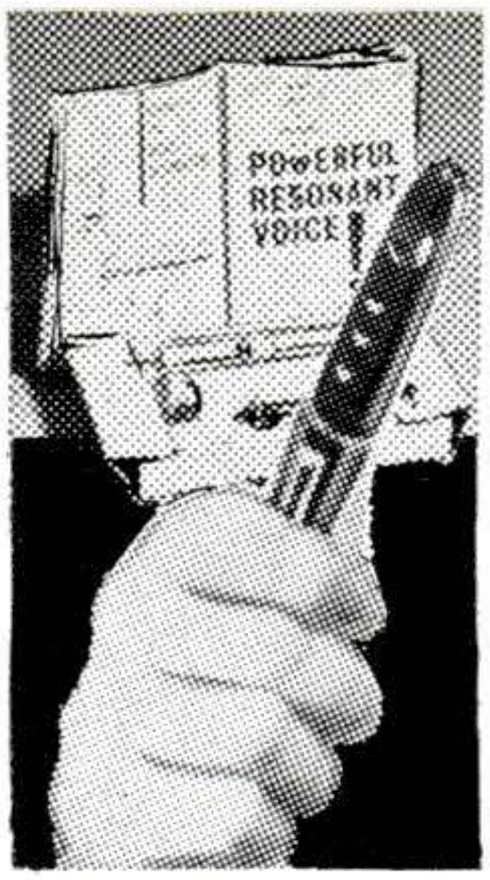

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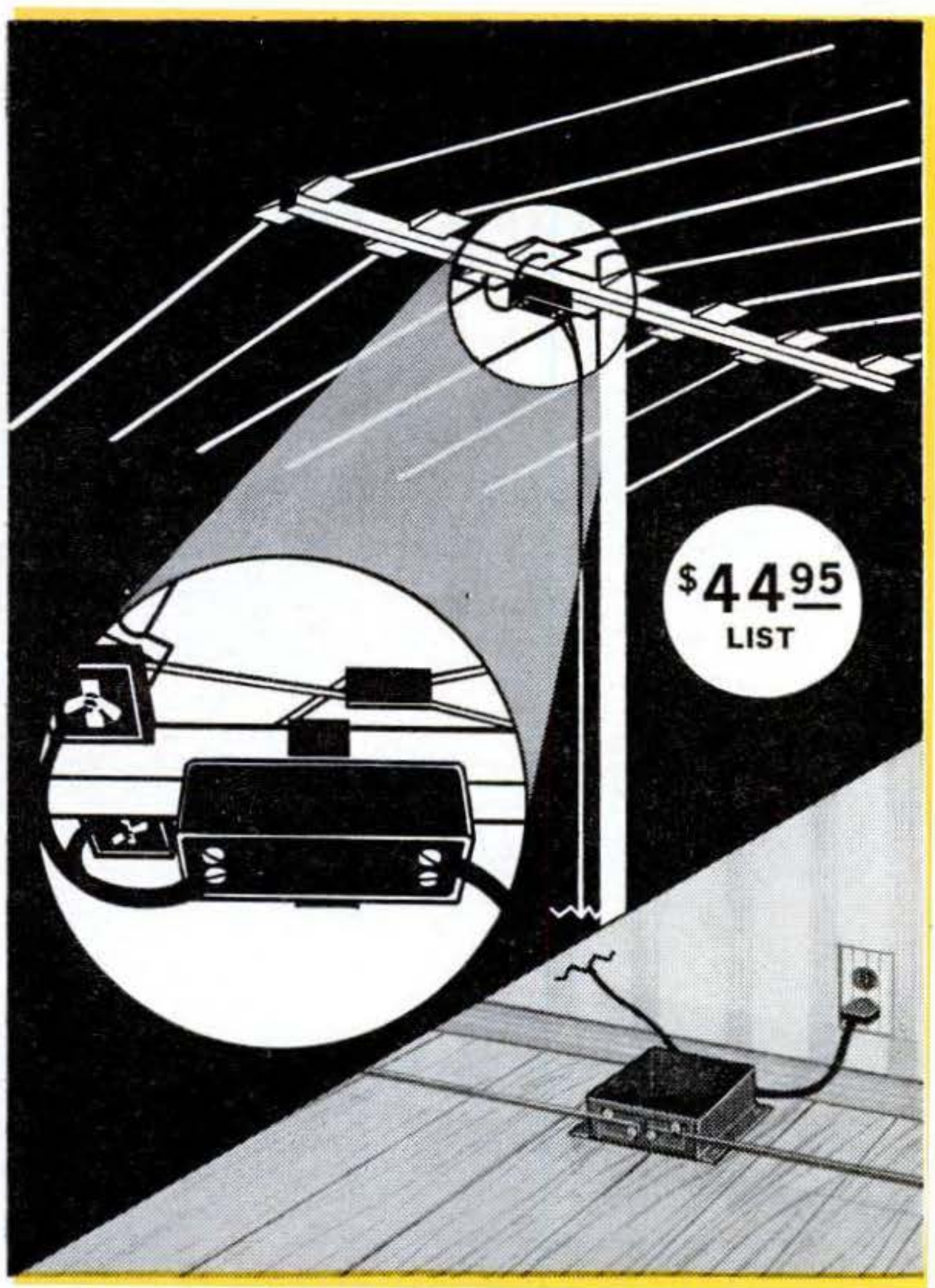

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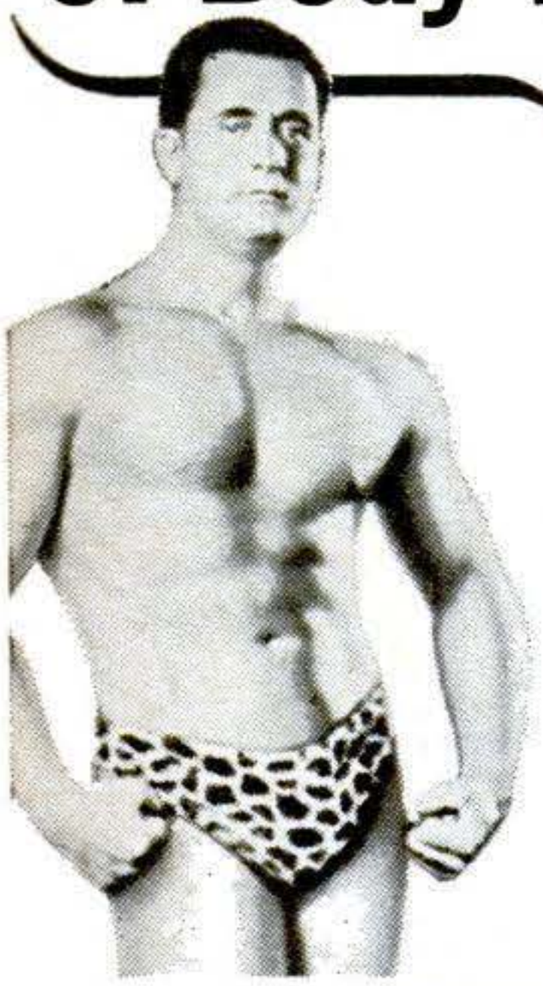

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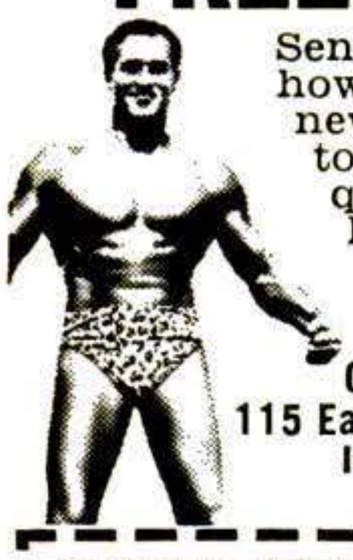

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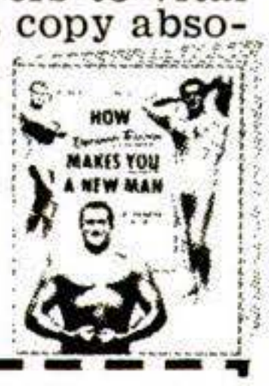

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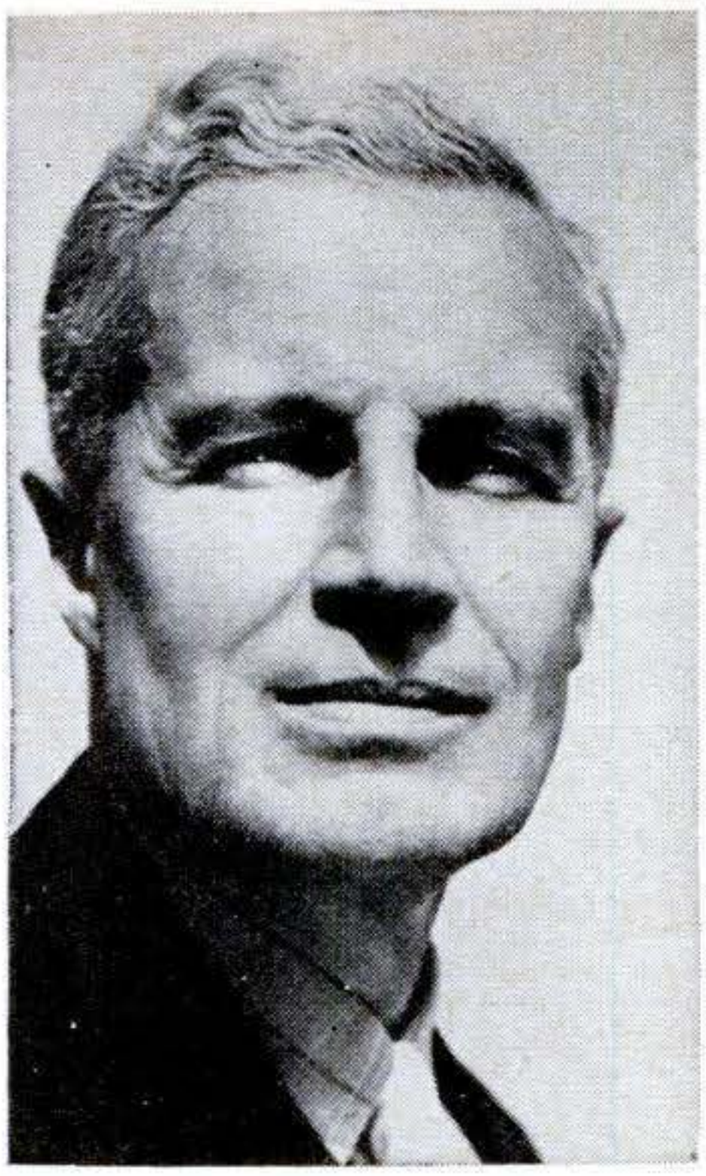

I'd like to give this to my fellow men...

while I am still able to help!

I was young once, as you may be — today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish!* And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned!* I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest $15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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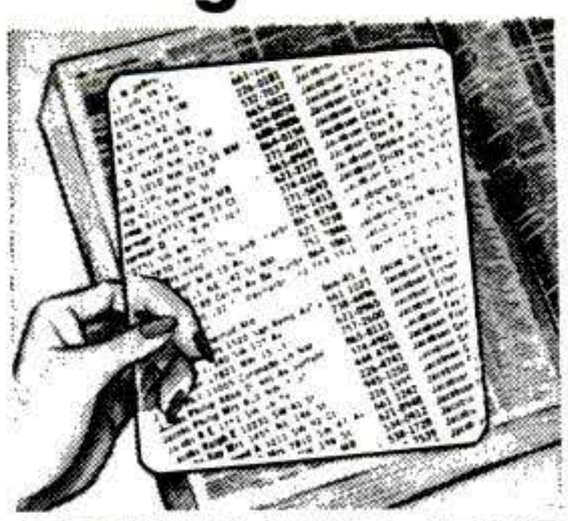

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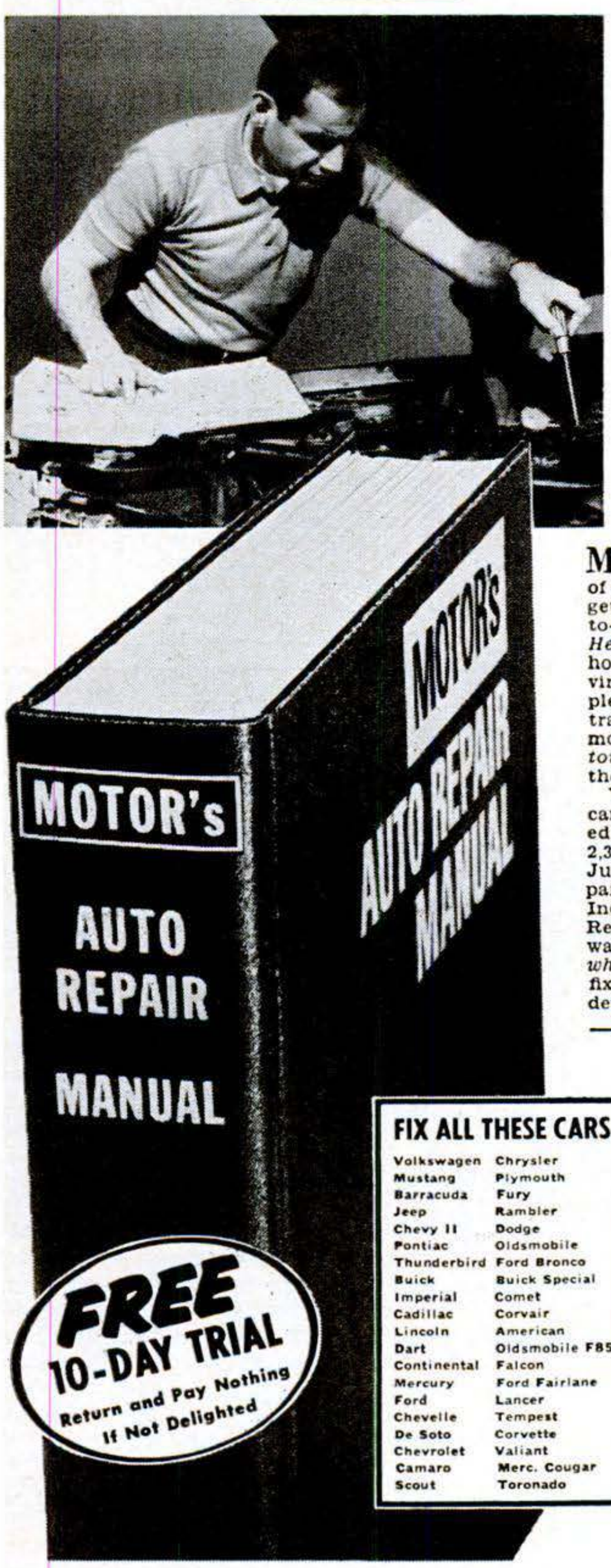

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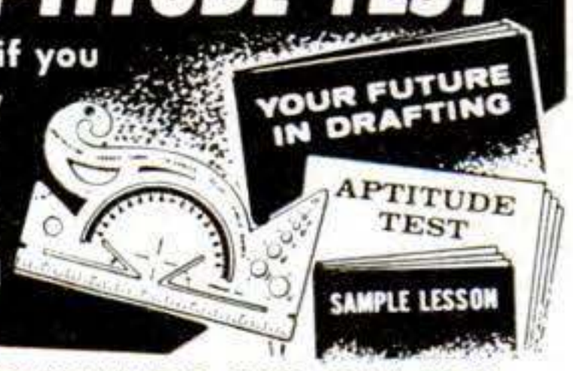

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This area has such a tremendous growth potential, such a fantastic, unlimited future, that wise investors have purchased large acreage. Bing Crosby's ranch was one of the largest cattle ranches in the county. James Stewart is honorary sheriff. Yes, the smart, experienced investors have sensed the future and are buying MEADOW VALLEY RANCHOS in Elko County, Nevada.

MEADOW VALLEY RANCHOS has all the factors needed to boom . . . to prosper . . . to skyrocket its land values. Ideally located in the prospering Elko Valley, The Ranchos have the backdrop of the statuesque Ruby Mountains. The sparkling Humboldt River actually flows through the property and is a valuable asset of the Ranchos. Every Rancho fronts on a graded road. The City of Elko, with its long established schools, churches, and medical facilities is MEADOW VALLEY RANCHOS friendly neighbor.

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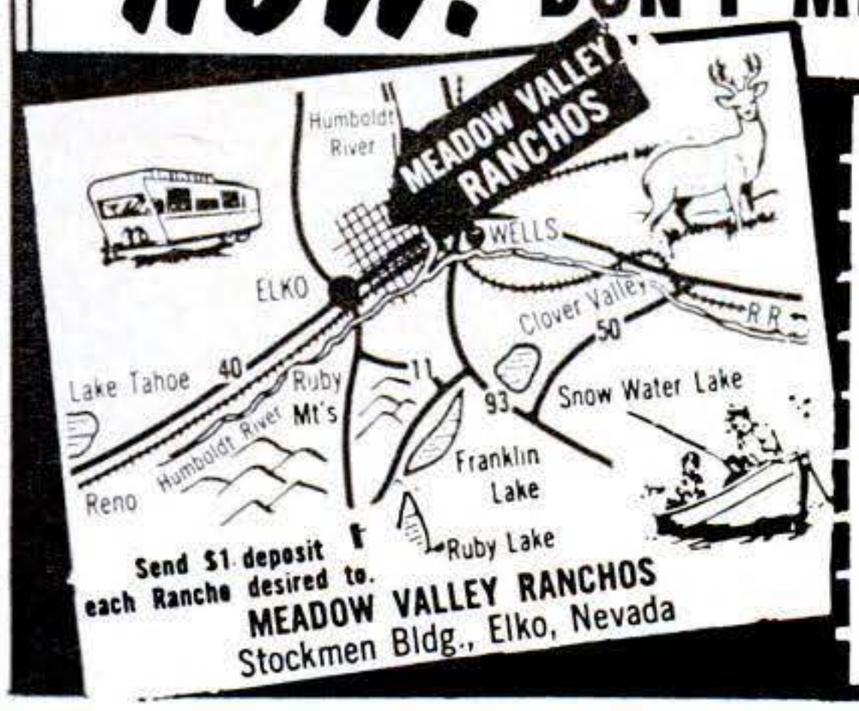

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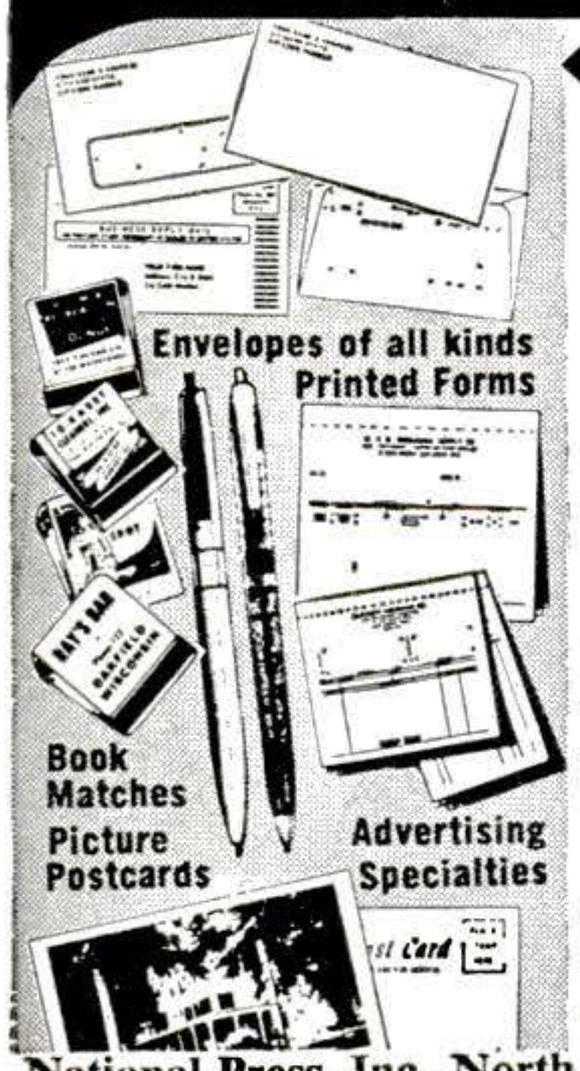

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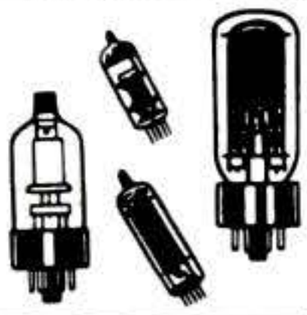

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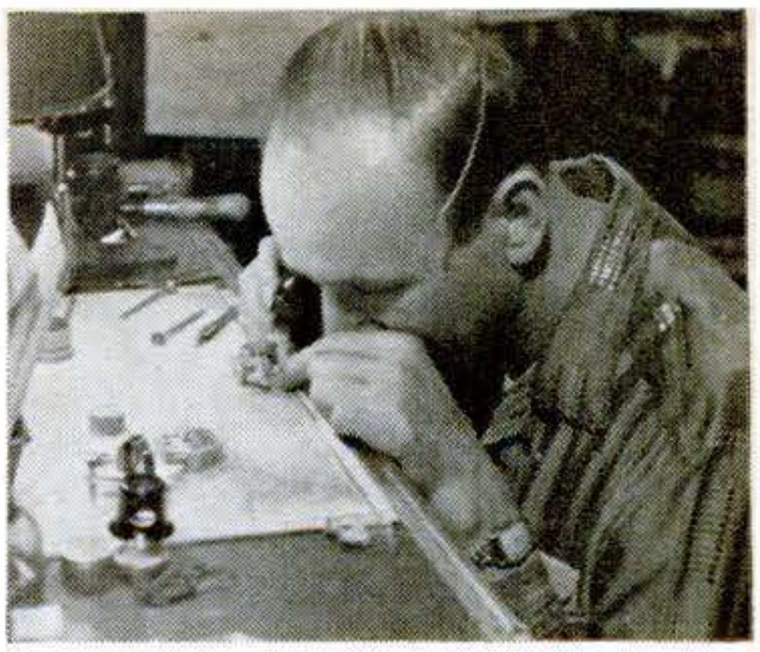

People learn watch repairing for many reasons: Some want a new career in this mushrooming trade. Others aim for the rapidly expanding precision instrument field. Some look for a second income. Others want lighter work or work after normal retirement. Some want the enjoyment of a challenging occupation. Others simply seek relaxation from the cares and tensions of the day.

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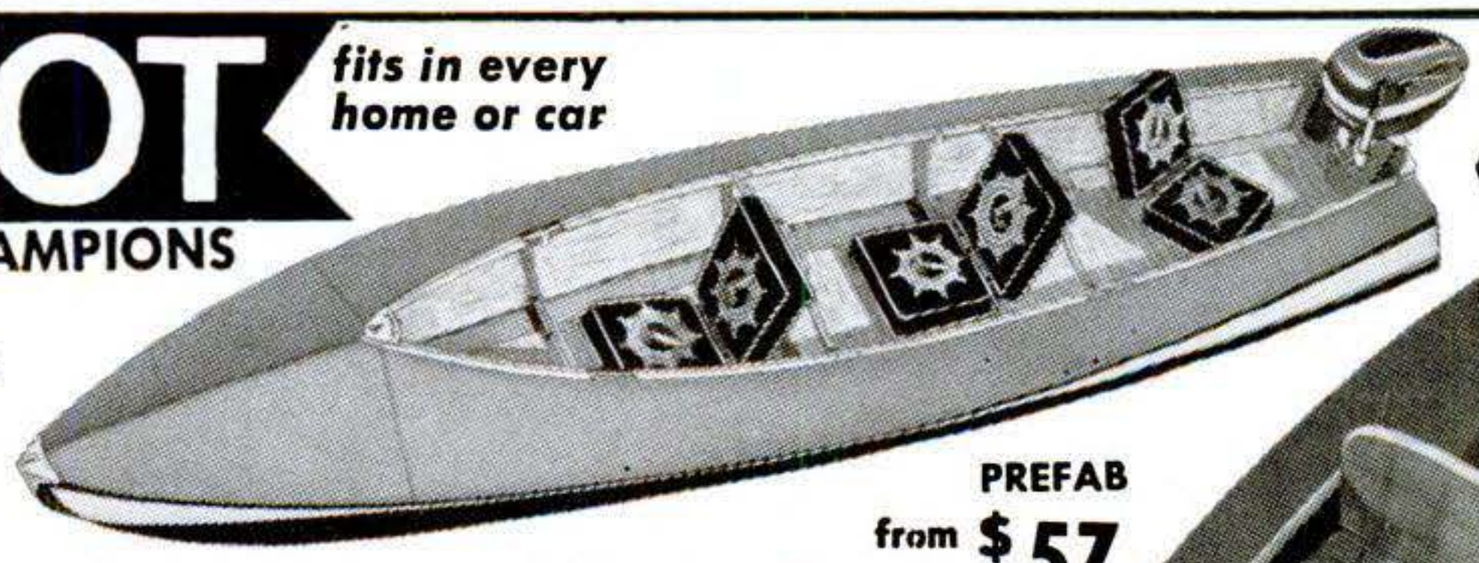

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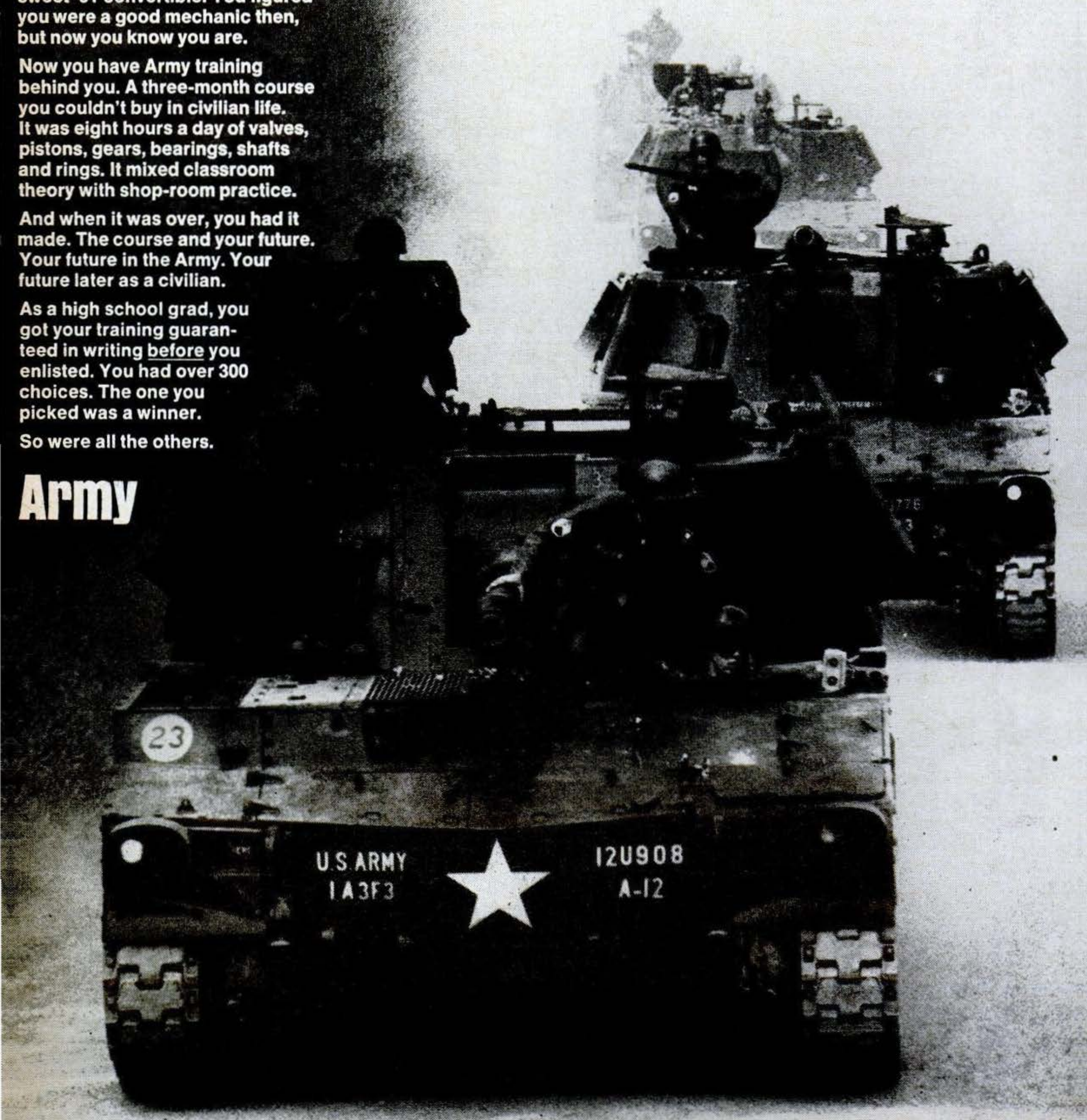

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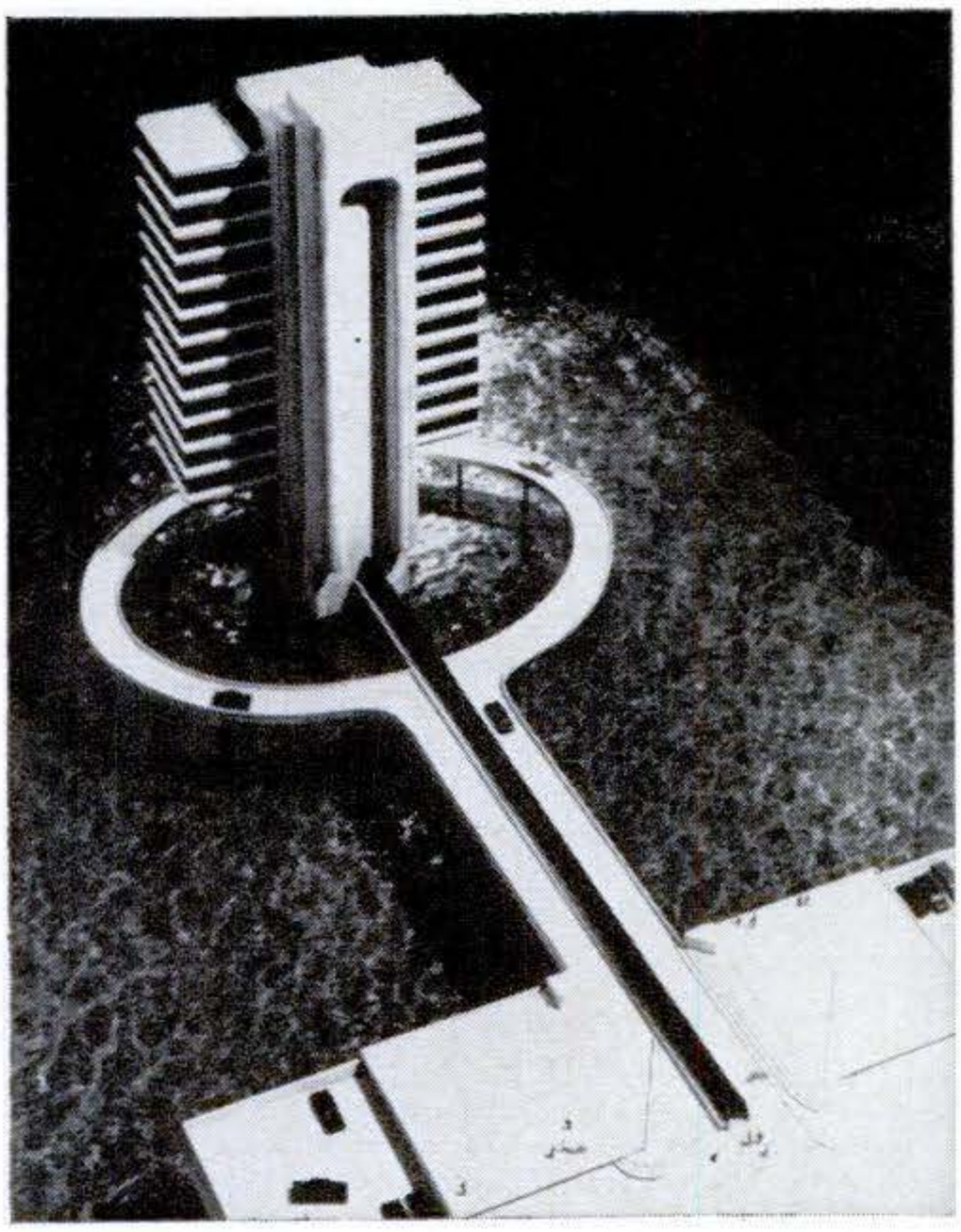

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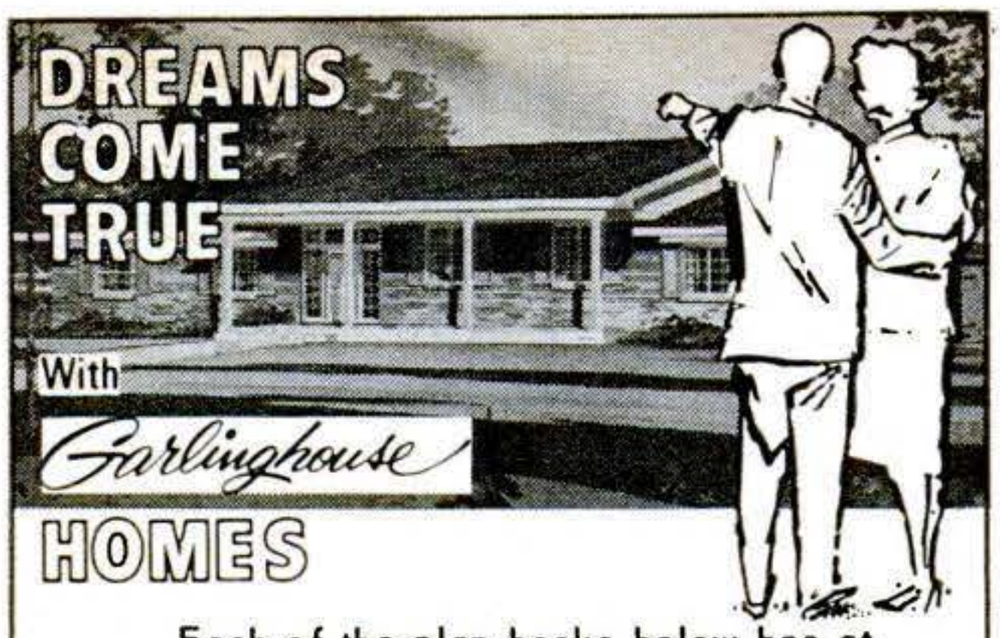

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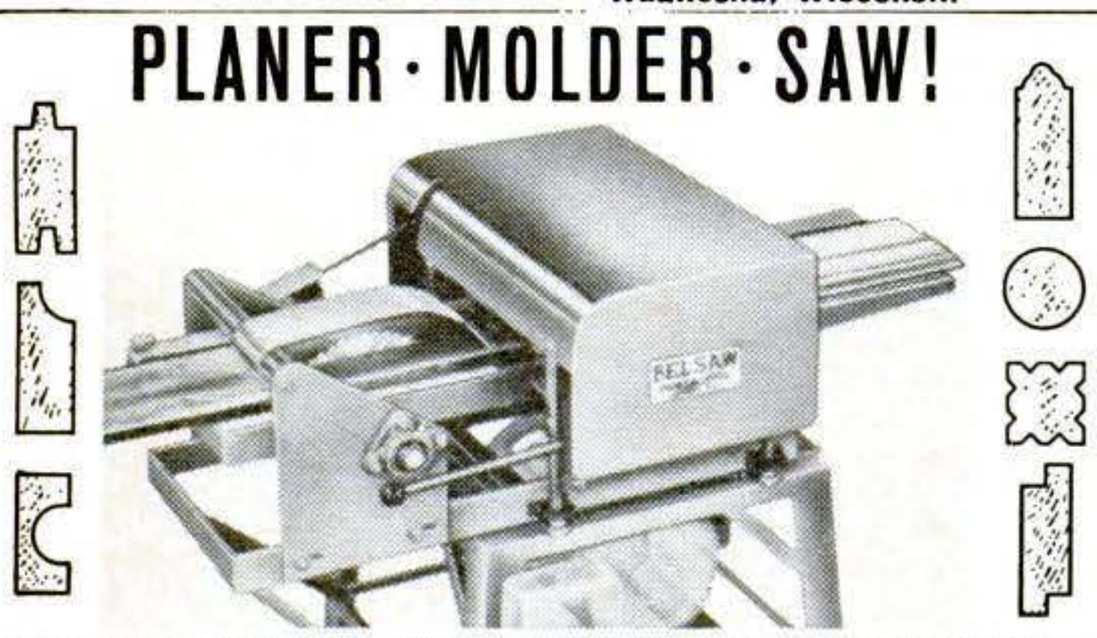

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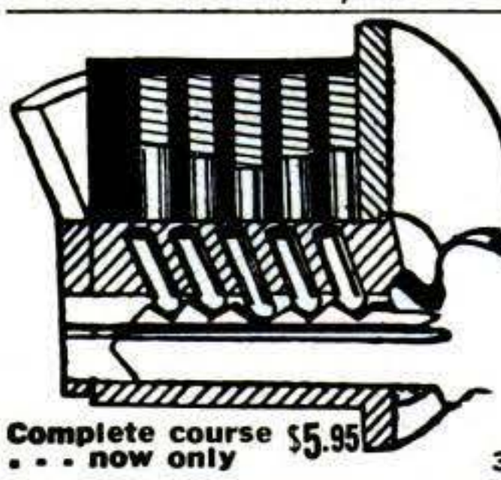

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Detroit Report...

HERE'S WHAT TO LOOK FOR IN NEXT YEAR'S FORDS: Fairlane's two-door hardtop will get a fastback roof line, severely chopped off at the rear like Mustang's 2 + 2. Rear window, wide and flat, will look somewhat like the Charger's. Fairlane will have a closer identity with the Galaxie line, especially in rear-end styling. Big swing away from front vent windows will continue: Fairlane and Comet are only two of the new cars that plan single-pane glass in front doors.

What's happening at Chevrolet? Is the world's largest auto maker slipping? Corvair sales have slipped badly this year—currently, Lincoln output is higher than Corvair's. Ford's Mustang outsells Camaro roughly two to one. Two months last year, Ford led Chevy in sales, and it has been a long time since that has happened. One big question in Detroit is whether Corvair will last out the model year. Production of this rear-engine car is below break-even point right now. Why can't Corvair make money on the number of cars it sells? Two reasons: First, it's a low-priced car; its cost is not paid for out of large profit margins. Second, just about every part used in the drive train and body of a Corvair is unique to that car, not shared by any other GM line. So all the tooling costs to build a Corvair are paid for out of Corvair sales alone. The fact that it shares little with other models makes Corvair's position extra shaky.

Ford's front-end collision research will result in some weird shapes in the chassis frame. An S shape bend in the frame ahead of the front wheel center has been successfully tested. It seems to offer the best hope for collapsible frame design. Theory is that the S bend will collapse more uniformly and easily than a straight frame member of the same metal thickness. Front-end overhang may also increase. Auto companies are discovering that the more car there is ahead of the front wheels, the more protection a driver has in front-end collisions. One big drawback with the S curve: Even a minor front-end accident will practically ruin the frame, since the curved section is twisted into fantastically intricate shapes while collapsing.

Automatics are continuing to take over the transmission market despite the boom of four-speed gearboxes in sporty cars. Right now almost all sedans in the medium-price class or above are equipped with automatics as standard equipment. Dodge says its Polara-Monaco line is 99 percent automatic. Dodge puts automatics on 89 percent of its intermediate Coronets. Eight percent are ordered with three-speed manual; three percent have the four-speed. Even with the smallest car, Dart, 80 percent are delivered with automatics.

Just what kind of gas turbine Detroit is cooking up for 1970 production is pretty well set. You won't find one in a passenger car, but Ford, Chevrolet, and Detroit Diesel (they make all the GM diesel engines) are agreed that big trucks will have turbines. Turbines from 300 to 700 hp. are almost as economical as diesels, and that's just the size these three big makers have in mind. Why not put one of these 300-hp. turbines in cars? They cost too much. Will we ever have turbines in American cars? The answer isn't clear, but Chrysler is now working on its fifth (!) generation turbine and is no closer to putting one in production than it was 10 years ago. Now, about those electric cars . . .

While the idea of an electric car in the near future is being pooh-poohed by most of the auto industry, pressure is building up in certain localities against the smog-producing internal-combustion engine. Make no mistake about it, when legislators and government agencies demand changes, the auto industry will produce them. Observers at the unveiling of GM's electric cars got the impression that the big auto maker was trying extra hard to say the internal-combustion engine cannot be matched for motive power. But now a California official proposes that only electric cars be allowed to operate in that state in 1980. Look for the auto companies to concentrate on complete elimination of smog emissions from internal-combustion engines. When that is accomplished, the electrics will not be needed. Or so the thinking goes, at least around Detroit.

Jim Dunne

Detroit Editor

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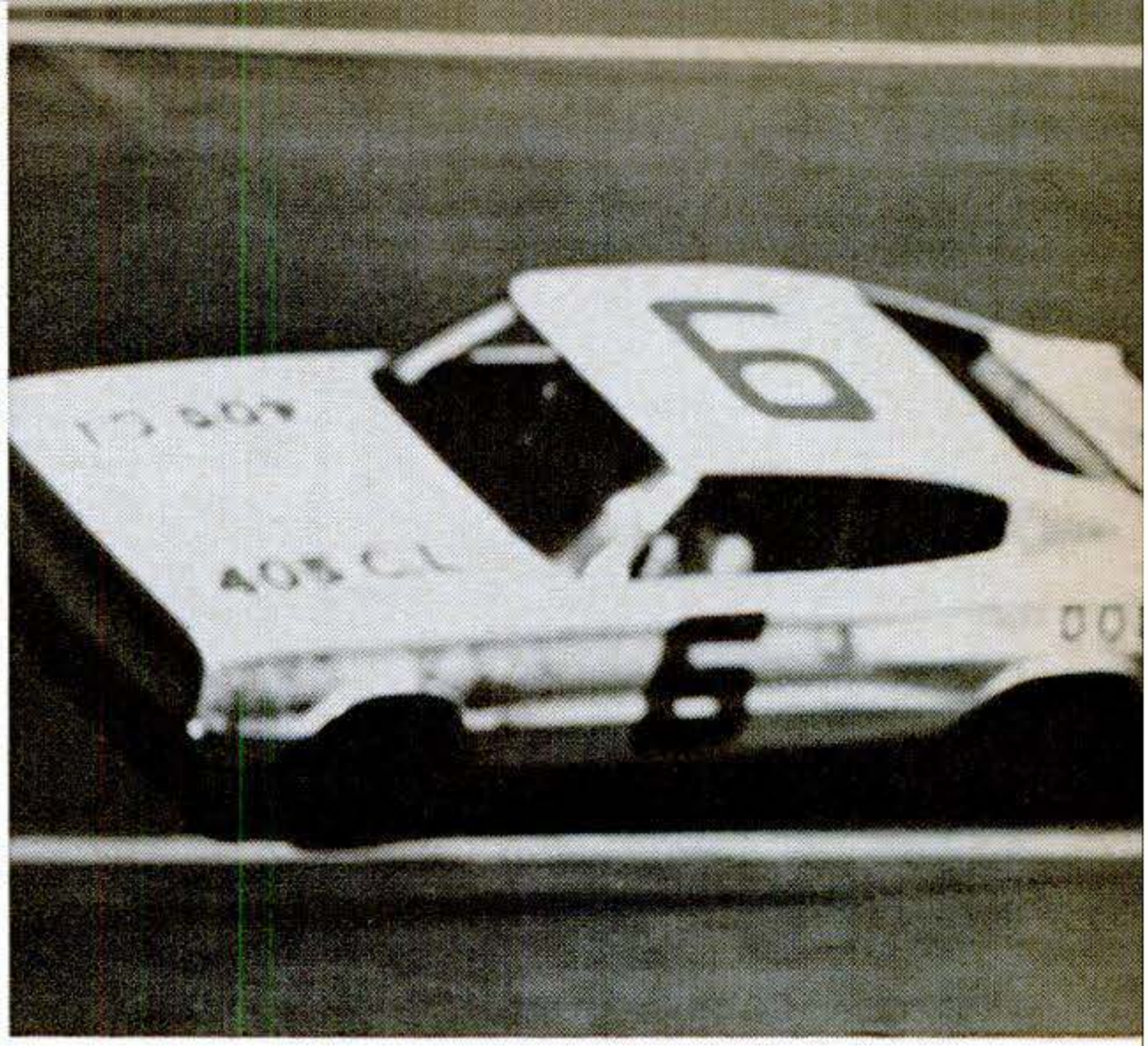
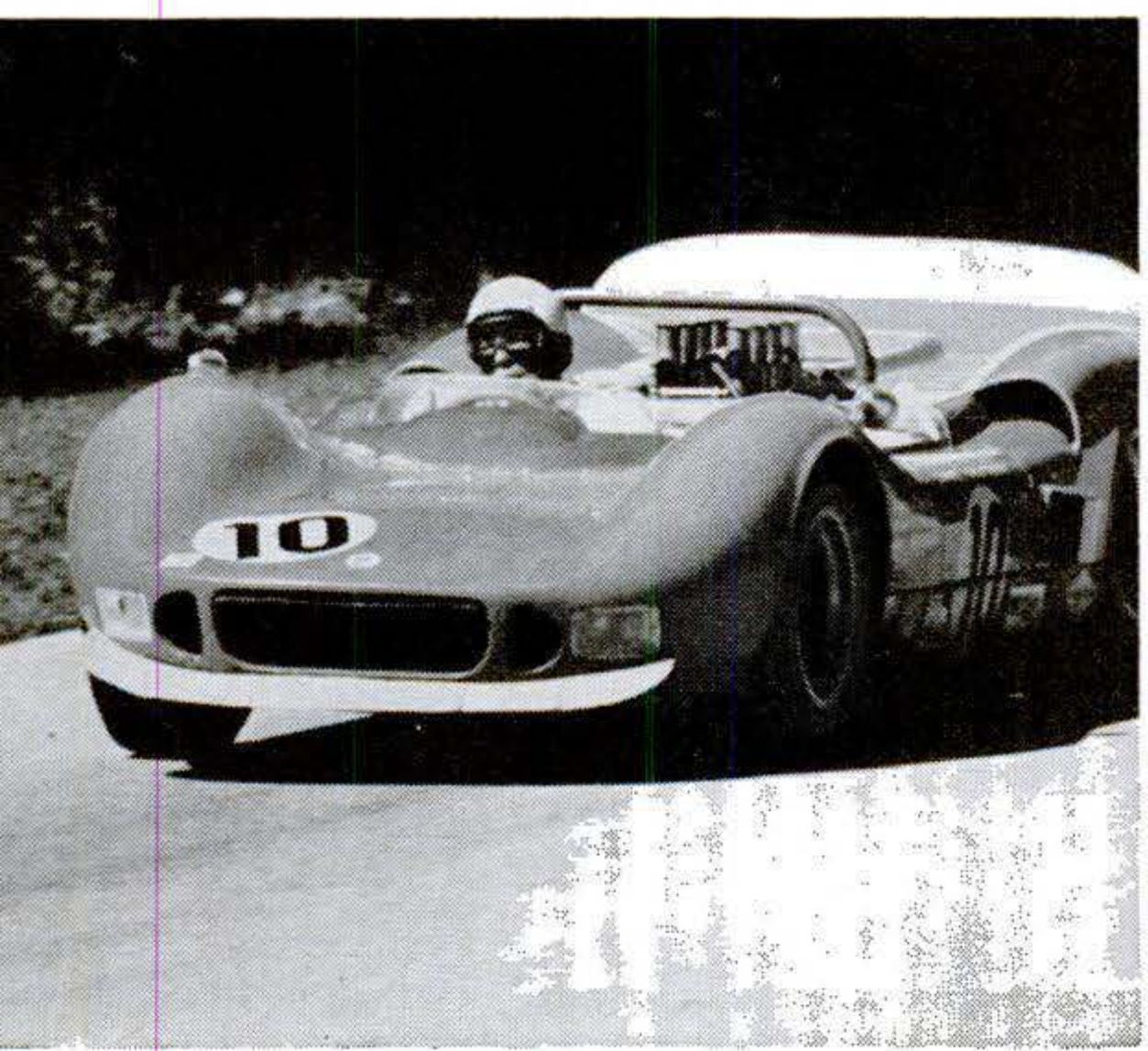
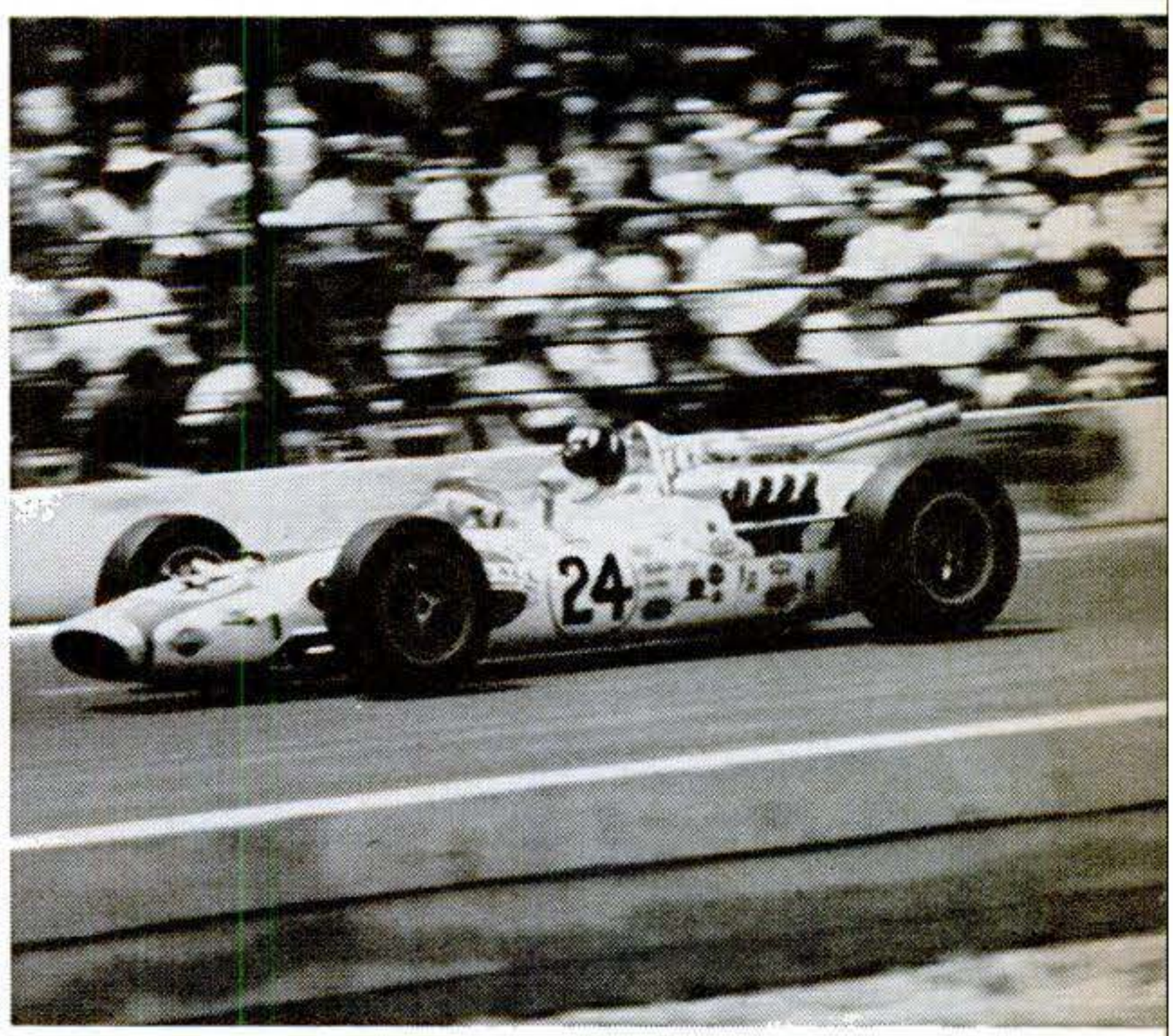
Champions spark Jack Brabham's Repco-Brabham to World Driver's Championship



Champions spark David Pearson's Dodge to NASCAR Grand National Championship



Champions spark Chuck Parsons' McLaren-Chevrolet to U.S. Road Racing Championship



Champions spark Graham Hill's Lola-Ford to Indianapolis 500 victory

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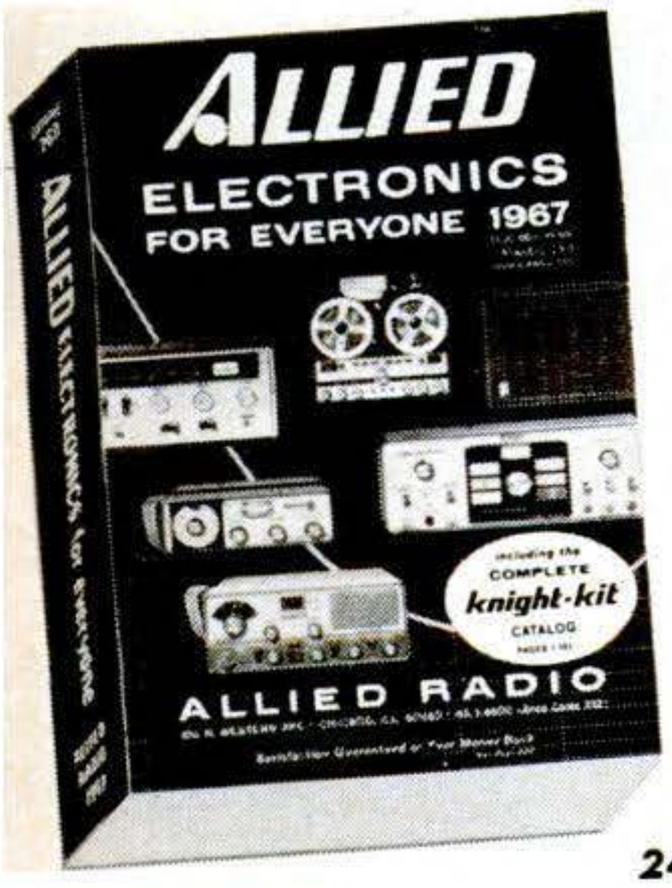

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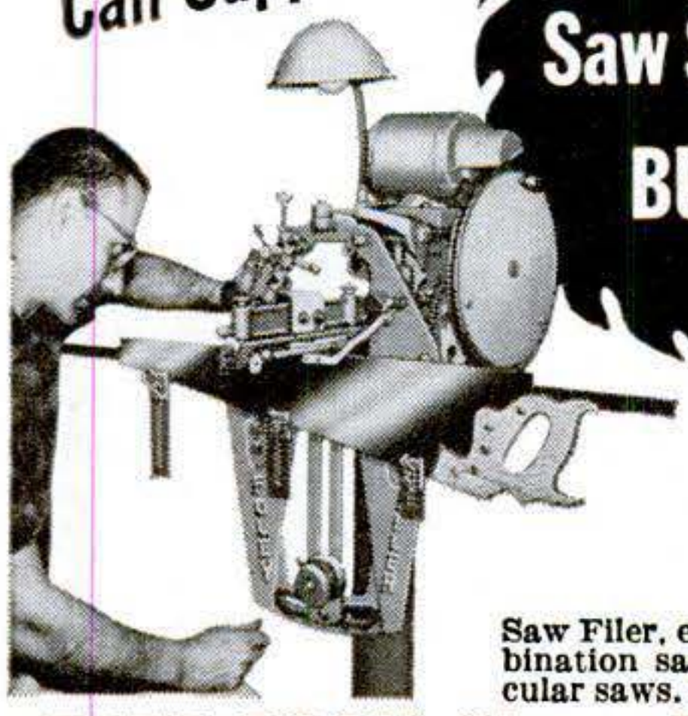

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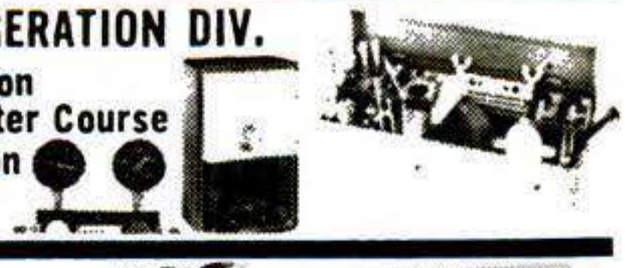

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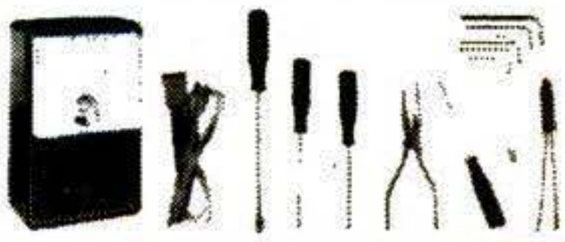

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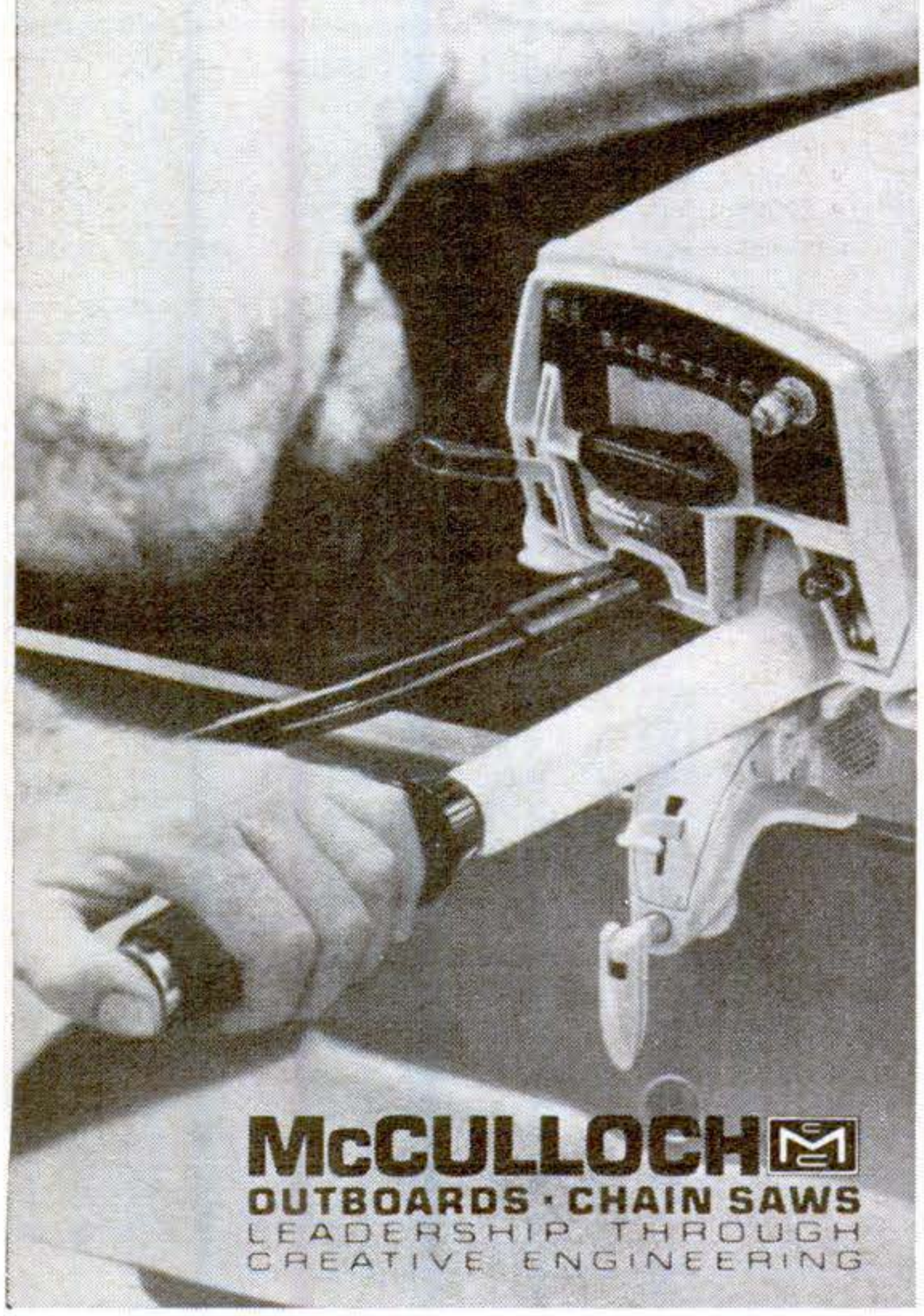

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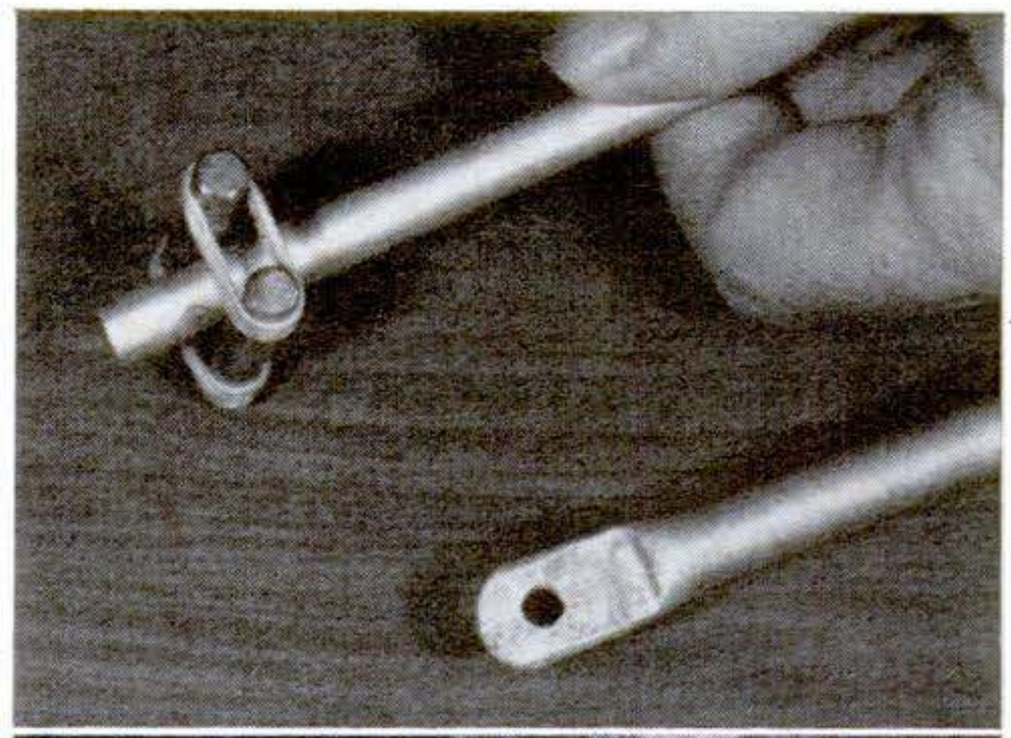

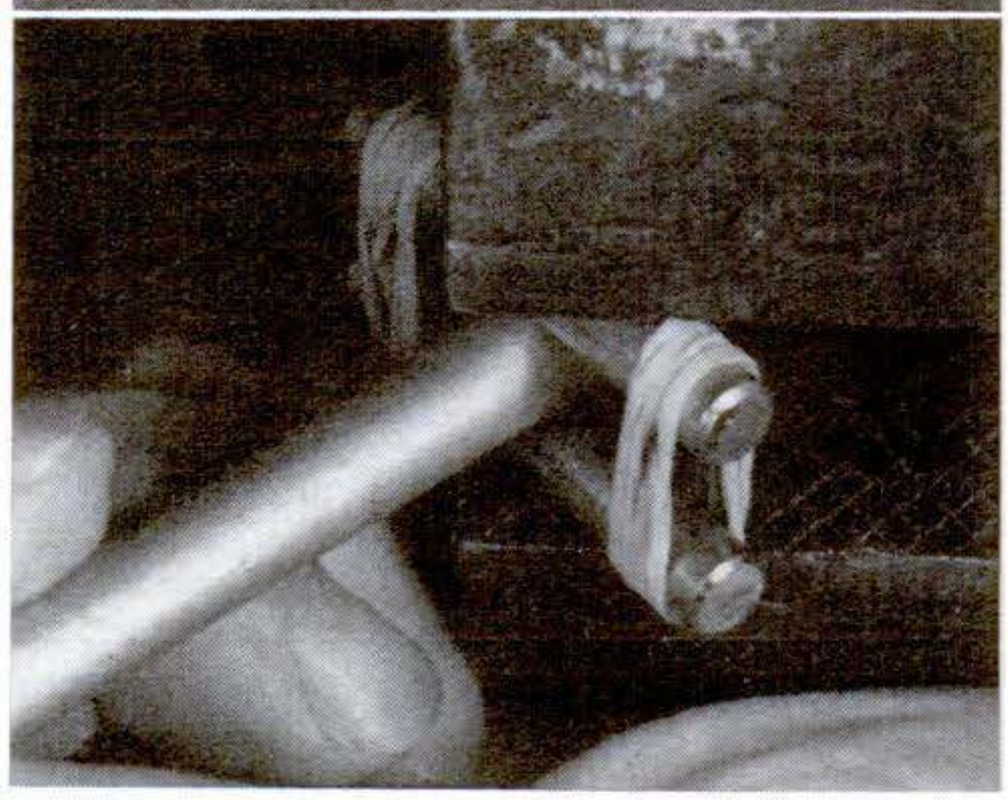

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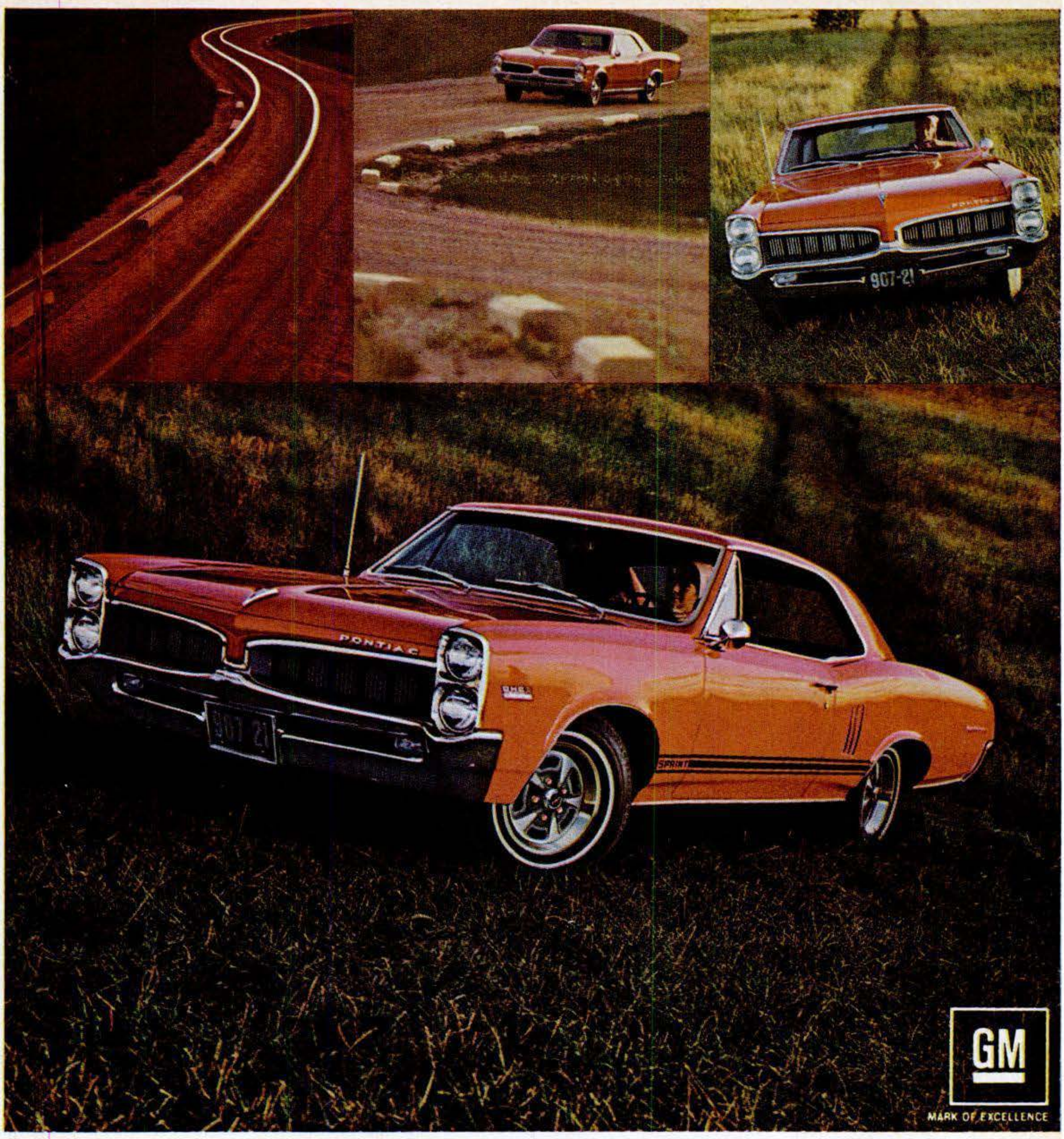

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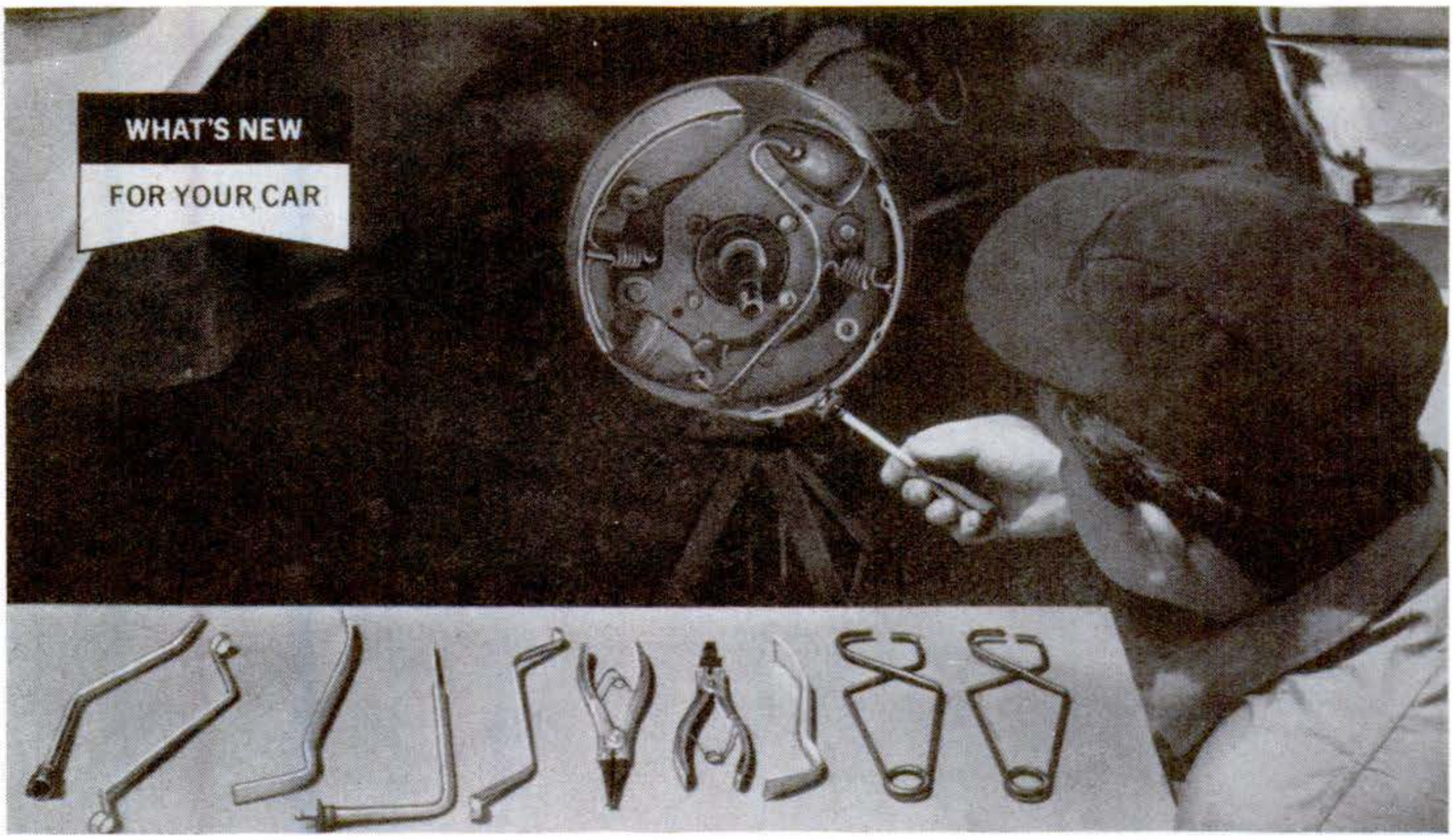

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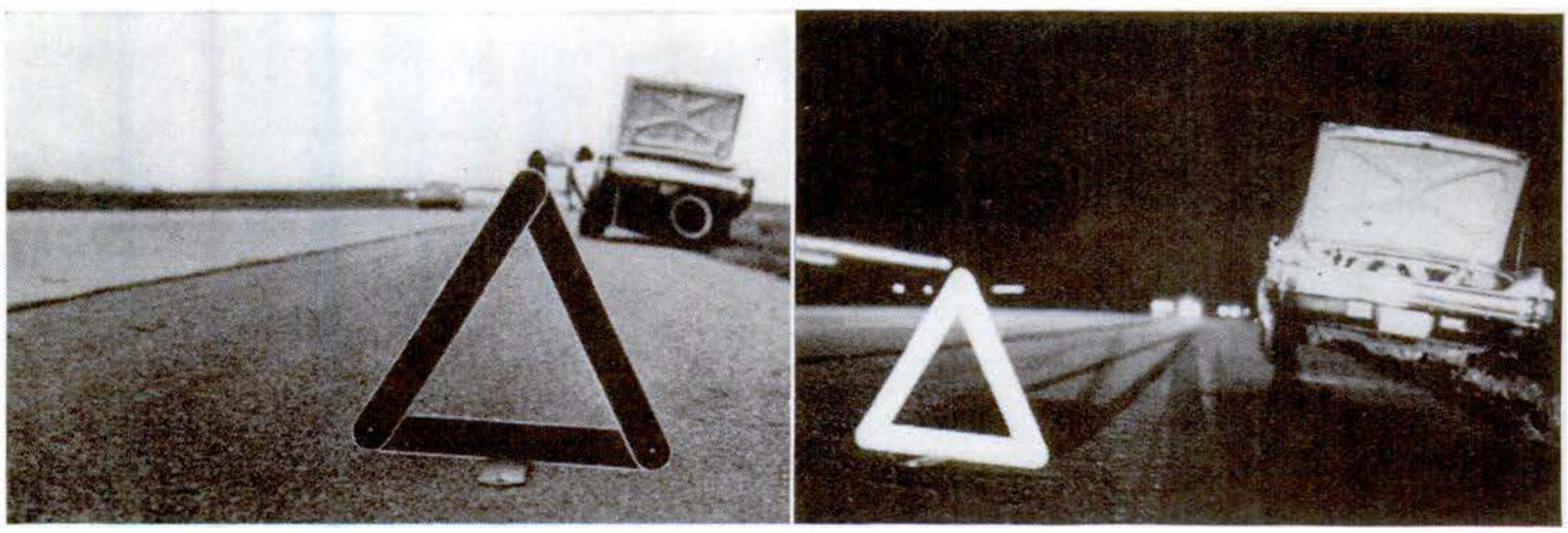
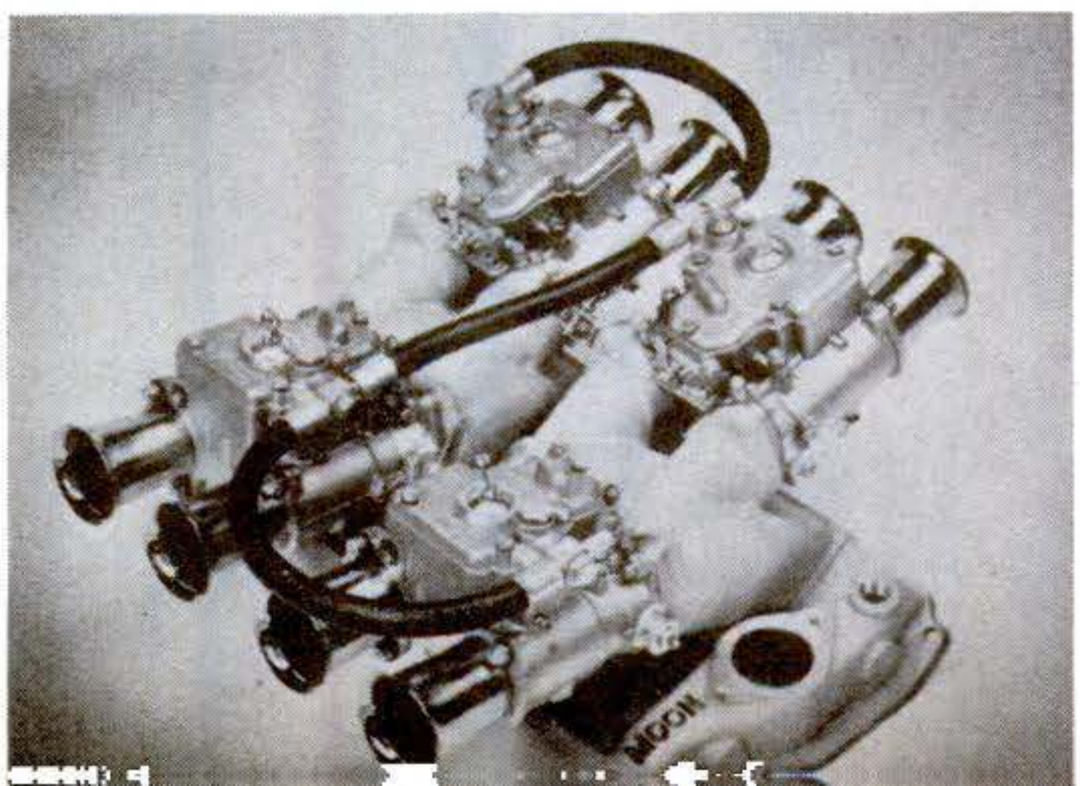


Lightweight portable warning sign for vehicles in trouble on the highway

This type of safety device is mandatory in most European countries and seems to be catching on in the U.S. The Deltalert is fully collapsible and takes up practically no car space when not in use. Surface is Scotchlite, mounted on galvanized steel. The mounting stand is said to hold the warning triangle upright in winds up to 40 m.p.h. AG-Tronic, Box 36, Hastings, Neb. 68901, claims it's visible a quarter-mile away, day or night. Price of the warning device is $4.49.



Four-carb manifold for your Chevy

Here's a sure way to boost power output from Chevy engines: Put four 45mm side-draft Weber carburetors on a special low-restriction manifold. The $595 kit includes ball-bearing throttle linkages, fuel harness, ram tubes, gaskets, retaining bolts, plastic carburetor covers, and a manual on tuning. It's low enough to fit under Chevy hoods, says Moon Equipment Co., 10820 South Norwalk Blvd., Santa Fe Springs, Calif. 90670.

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This is a GM Original: It can turn 12 volts into 25,000.

This is a GM Replacement: It performs the same feat.

GM Originals have an act that's tough to follow. But not for GM Replacements. Because they're the same in every way.

Good thing, too. Especially if you ever have to replace anything as important as the ignition coil. That's the rugged part that takes regular battery voltage and steps it up to the voltage necessary for good engine performance. Which could be up to 25,000 volts!

You can get GM Parts, in GM and United Delco packages, just about everywhere. Go where they use them. Good service goes with good parts.

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1967
the year of the Sea-Horse

18 purebreds in 10 power classes — performance backed by our 2-year warranty*

TRIM TWINS Sweet and low 9½ (pictured) is the world's best-selling outboard. Others are the Slick 6 and 5. Twin-tote 3's come "straight" or fold-away. Both are available as high-thrust with right-angle drive and 3-blade prop or Angle-Matic with weedless 2-blade prop.

TORRID TWINS Start with the Fast 40. Available as Electramatic, standard-electric or manual start. The 33 comes standard-electric or manual starting. Our high spirited 20 (pictured) rounds out the middle of our line with refinements for amazing fuel economy.

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Power/Pulse ignition for Johnson V-100

No breakers, no points, no condensers — smooth power throughout the speed spectrum

This little black box is the heart of the solid-state system that eliminates ignition service and adjustment for V-100 owners . . . that promotes instant starts followed by uncanny smoothness, even at the slowest idle, regardless of the engine's state of tune . . . that has such an anti-fouling effect on spark plugs you can expect 5 to 10 times longer plug life. This tremendous performance booster is more — much more — than you get with any other production ignition system. Standard on the Sea-Horse V-100. Other V-100 standards are Electramatic drive (gears shift automatically, electrically) and a host of refinements that enables it to run on less fuel than last year's model.

FORMIDABLE FOURS Among Johnson's bold crew of big V's is the versatile V-80 (pictured). Two models: One is Electramatic with exclusive fully automatic shift and throttle control. The other standard-electric with mechanical forward-neutral-reverse transmission. The V-60 Sea-Horse is also available in two versions. One with high-speed gear case for medium loads and hulls. The other with heavy-duty, high-thrust gear case for big loads. New adjustable stern bracket is standard on our V-4's — makes it easy to position your engine for maximum performance.

Get all the facts on our '67 Sea-Horses at your Johnson dealer. He's in the Yellow Pages. Or write direct for your *free* copy of our fun-filled, full-color 36-page catalog. Johnson Motors, Waukegan, Illinois 60085. Dept. PS-27.

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BLUE WATER WINNER!

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A pair of superb Northland water skis

The rules are easy; simply drop into your nearest participating Glasspar dealer and fill out the free entry form. That's it; no obligations, nothing to buy.

The winners will be selected in a random drawing. Hurry! Offer closes March 30, 1967.

Offer void in Wisconsin and wherever prohibited by law.

Excellence backed by five years of written warranty protection.

BLUE WATER BOATS

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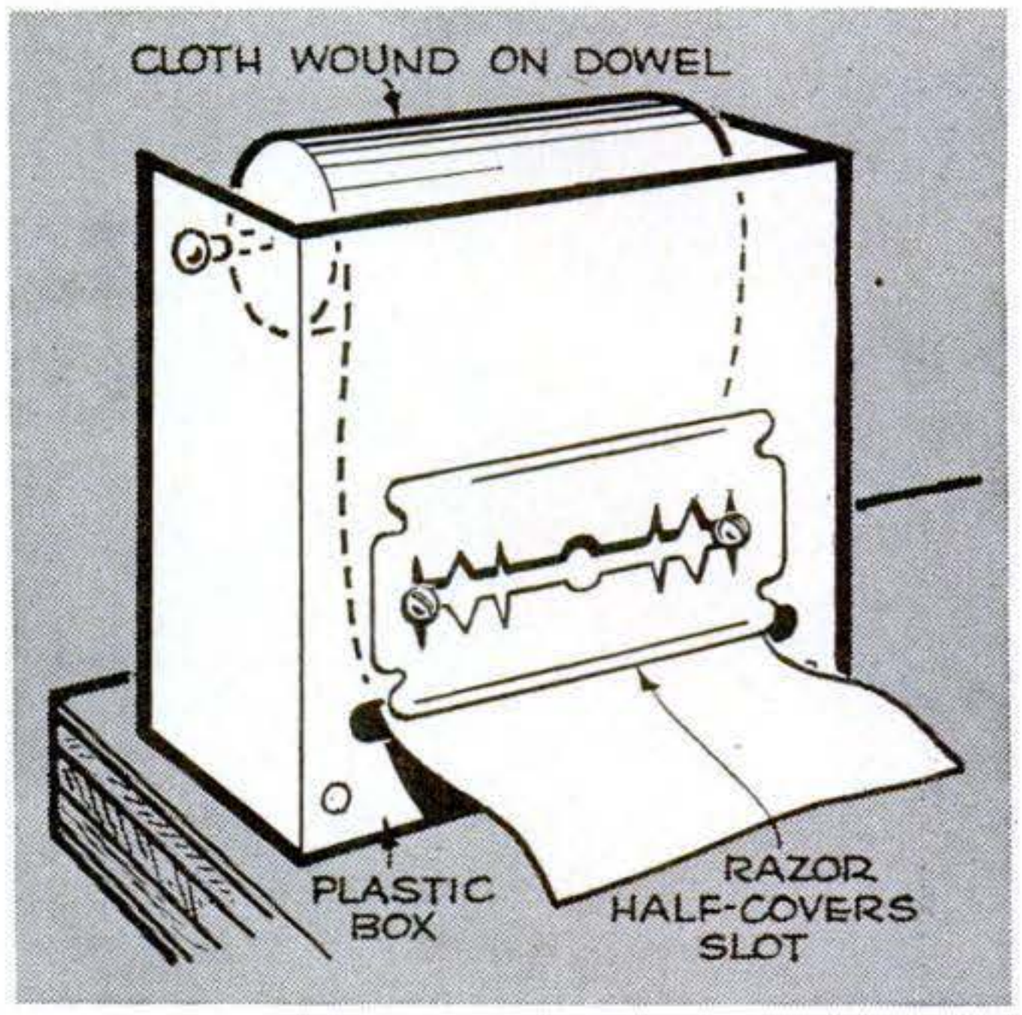
SHORT CUTS AND TIPS

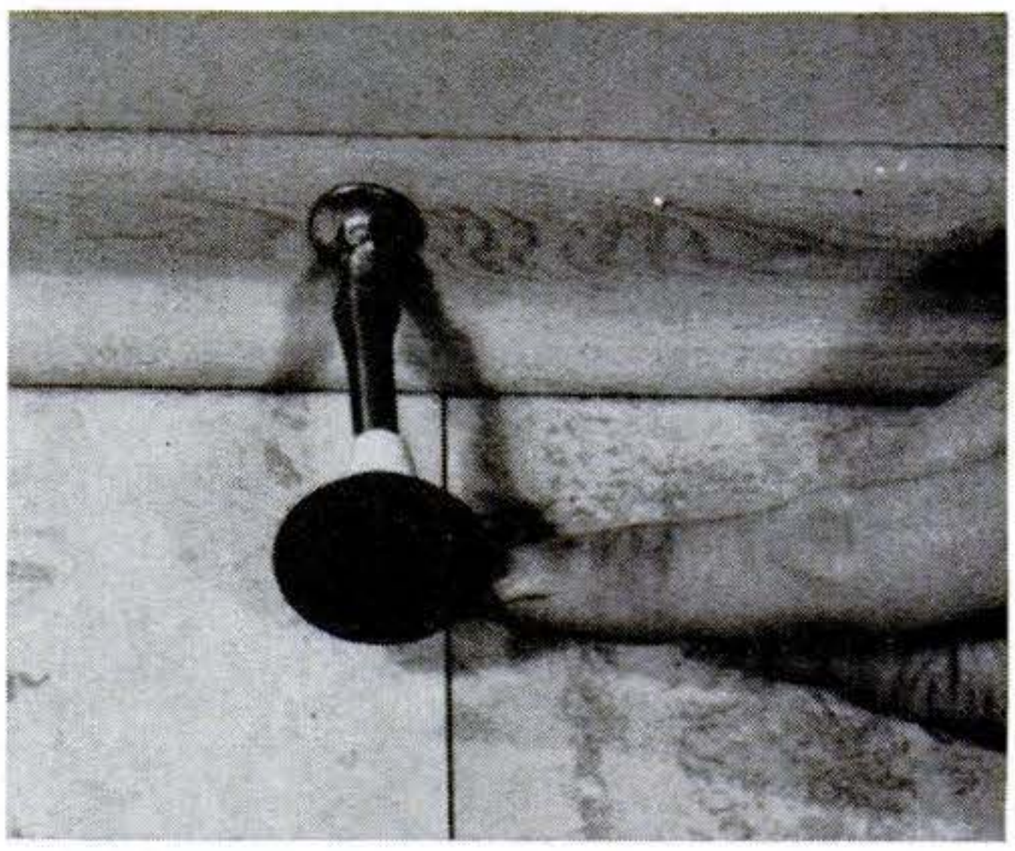
FROM PS READERS



Pen wiper cleans drafting tools

Make this pen wiper and tack it to your drawing board so that it will always be handy. Cut the end off a flat plastic box, make a slot near the bottom, and fasten a razor blade, as shown in the drawing above. Drill a hole lengthwise through a short dowel and fasten it in the box with an 8-32 machine screw and nut. Wind a strip of cloth around the dowel and pull the end of the cloth out through the slot. The razor blade cuts off each section of cloth as it is used.

PETER LEGON, Malden, Mass.



Suction cup stops door

If you have trouble with a door that won't stay open or blows shut with the slightest breeze, try fastening a suction cup to the end of the doorstop, as shown above. Press the door firmly against the cup.

KEN PATTERSON, Regina, Sask.

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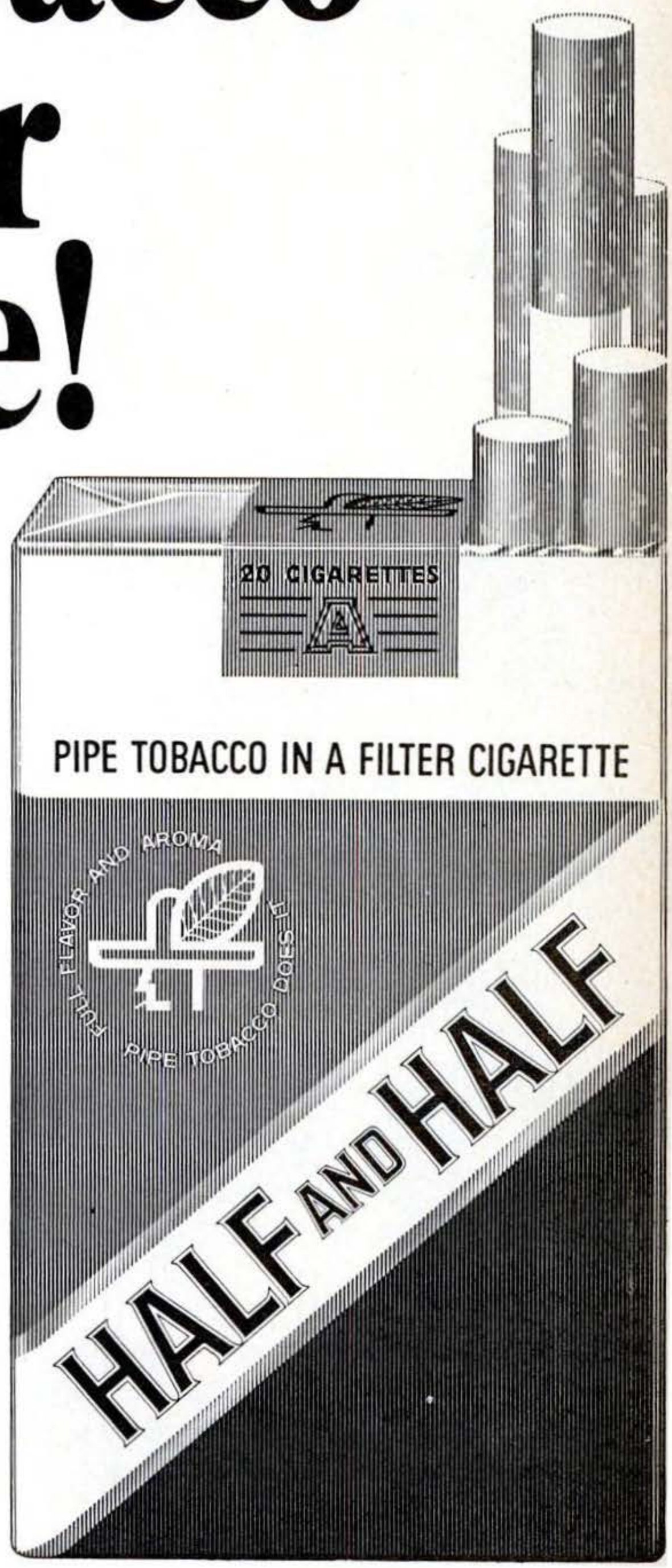
Get extra flavor: Pipe tobacco in a filter cigarette!



Taste the one cigarette that can give you extra flavor and lots of it. Half and Half—the cigarette made from pipe tobacco. Once you sample that rich tobacco flavor and aroma, you'll never be quite satisfied with any other cigarette again.

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What kind of man uses Vaseline Hair Tonic?

His host has just been shot

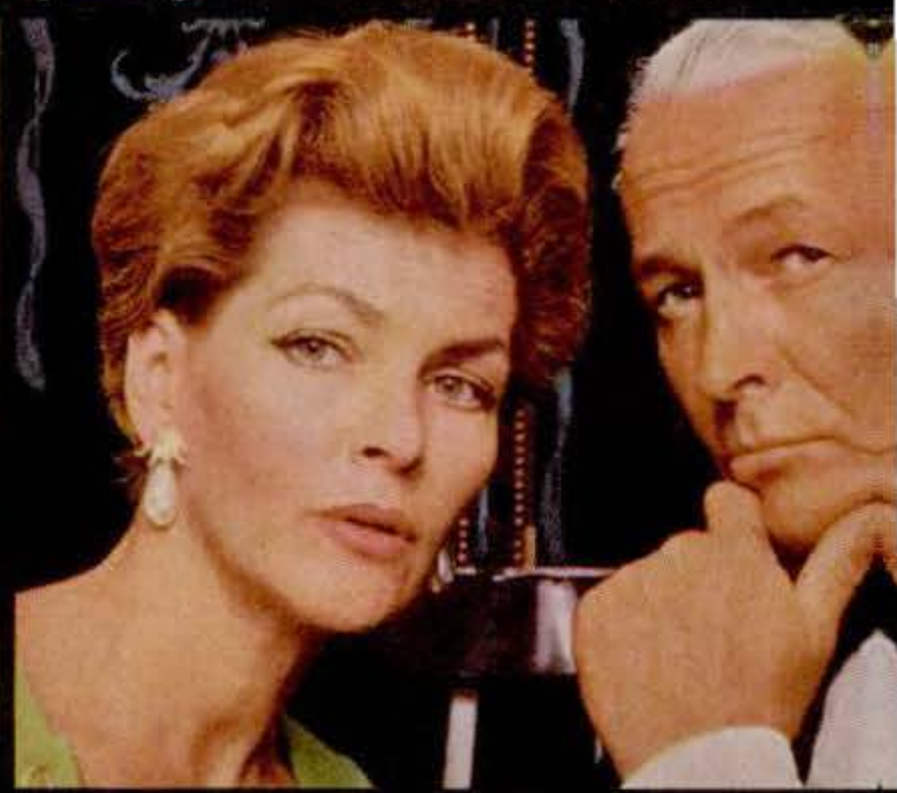
"I saw her shoot him."

"No! I just picked up the gun."

"You're a liar..."

"I saw smoke pouring from the gun, my dear."

"Impossible, you're the liar."



How does he know?

.38 caliber cartridges are virtually smokeless.

Some men are hard to fool.

The man who knows how to take care of himself uses Vaseline® Hair Tonic.

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Fun Cars You Can Build from a Kit

Start at the junkyard for materials for these agile, tough poppers that will go anywhere

By JAMES W. WRIGHT
PS West Coast Editor

Two of the most versatile, all-around, go-anywhere, all-out fun cars being built today aren't being built in Detroit, or in any big factory, for that matter. They're being built by guys like you and me in home shops, garages, and backyards all over the country.

They're called the EMPI Sportster and the Meyers Manx. They come in kits, and with a few simple tools plus a few spare evenings and a weekend or two you can put together a vehicle that will outperform about any-

Continued

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Here's one eloquent example of the versatility of fun cars. Deep sand, either level or on a 60-degree hill, offers no obstacle. Nor do mud or snow, or steep, badly rutted, boulder-strewn slopes.

thing on four wheels on hard-going terrain.

Both cars are based on relatively inexpensive, easy-to-obtain Volkswagen components. These include the front and rear suspension, chassis platform, steering, front seats, instruments and switches, tail lights, turn indicators, transaxle, and engine—about everything but the body and fenders. Stock wheels and tires can be used, but as we'll see it's best to replace them with special units for improved performance.

Both EMPI (Engineered Motor Products, Inc., Riverside, Calif.) and Meyers (B. F. Meyers & Co., Newport Beach, Calif.) recommend 1961 and later VWs as a basis for their kits. This is because of the 40-hp. engine and synchro first gear that were introduced that year.

The thing to look for is a VW that hasn't suffered too much front- or rear-end damage. One that has been rolled over is usually perfect. These are pretty easy to find, with prices ranging from about $200 to $500-$600 for low-mileage '66 cars.

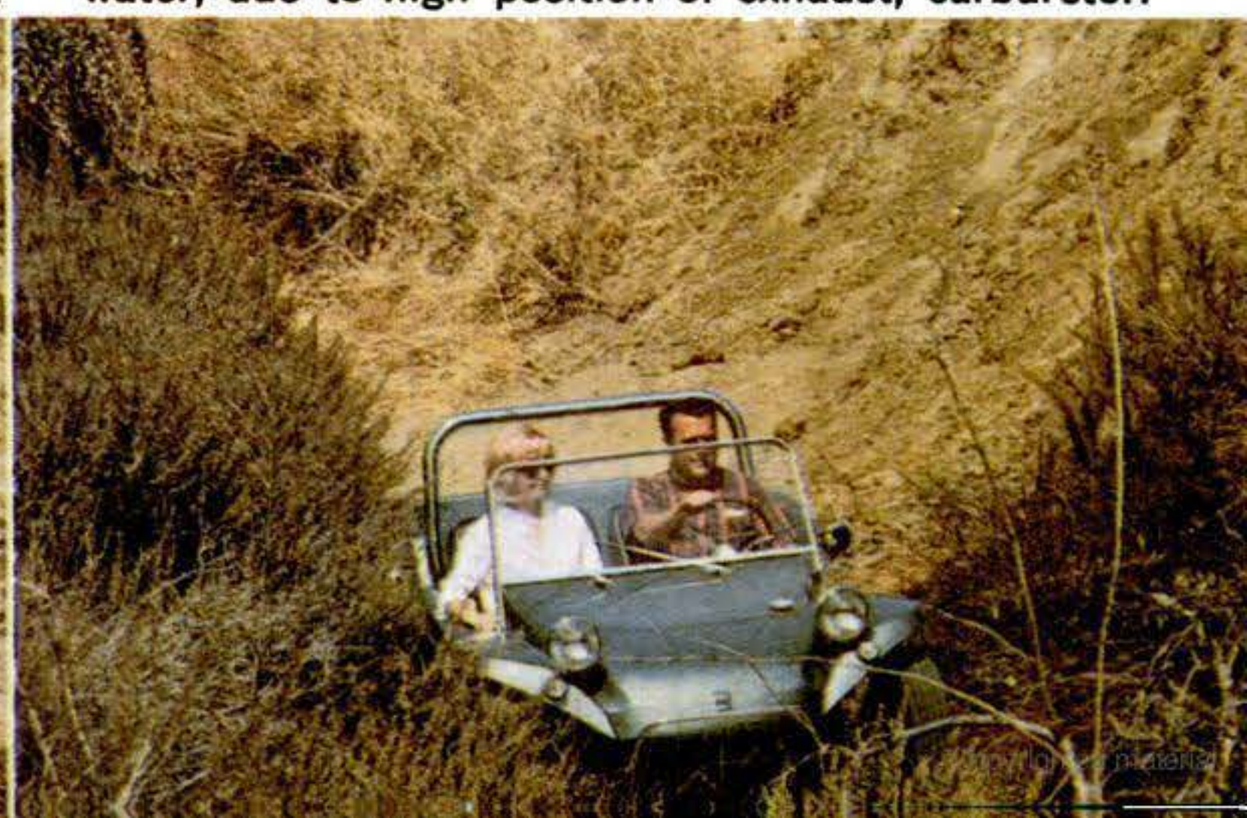
The power. Engines aren't limited to the 40-horse version. The earlier 36-hp. engine will do a good job and the later 1,500cc and 1,600cc units are excellent. For those who want more power, the chassis and transaxle will also handle a Porsche or Corvair engine. Several companies are making adapters that allow the Corvair to bolt right to a VW transaxle. No modification of the Sportster kit is required. Stiffeners needed in the Manx body are installed for you on order by Meyers.

While the basic concepts of the Manx and

Continued

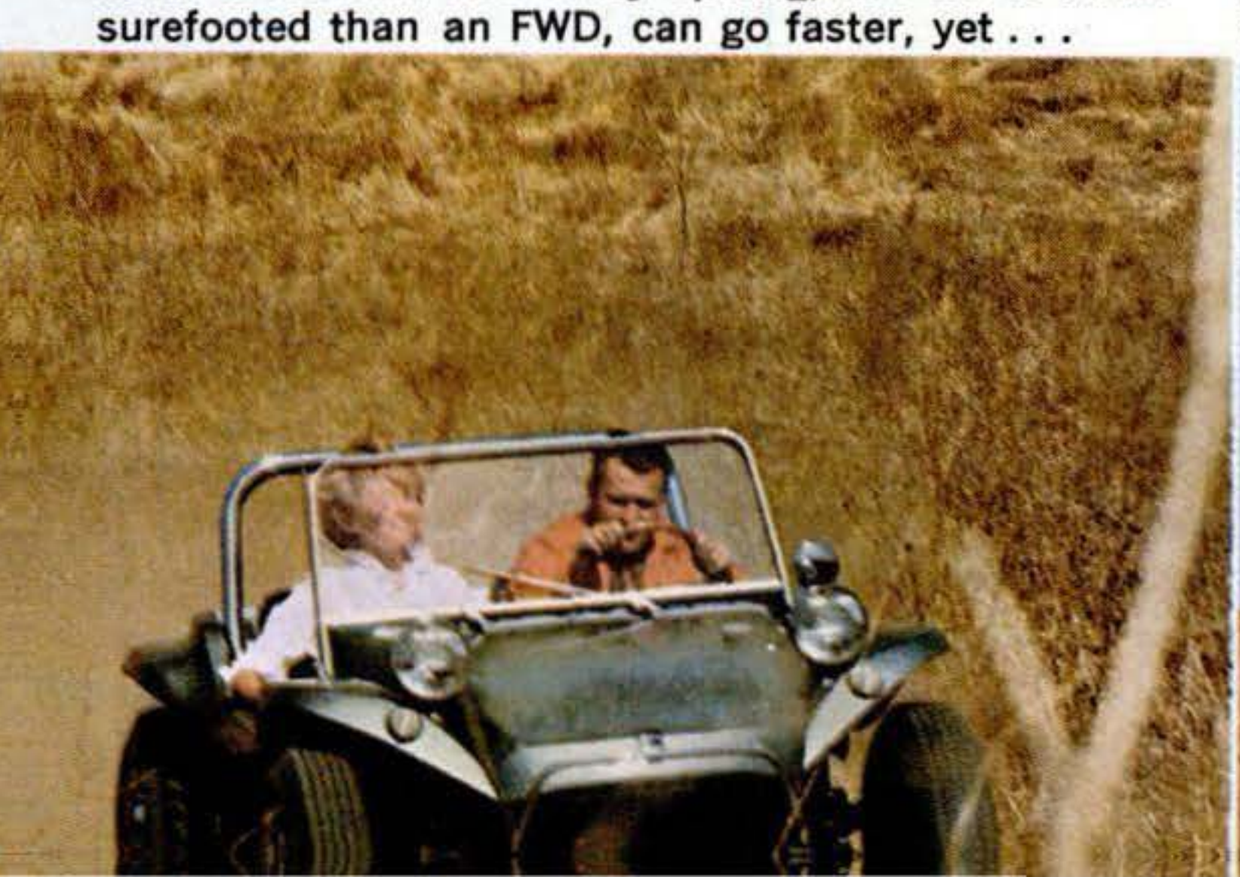
Upswept, special exhaust, like this one on a Manx, affords ground clearance for off-road driving. A steel skid plate protects transmission and crankcase.

Bottom of a gully poses no problems. With waterproof ignition system, Manx gets through fairly deep water, due to high position of exhaust, carburetor.

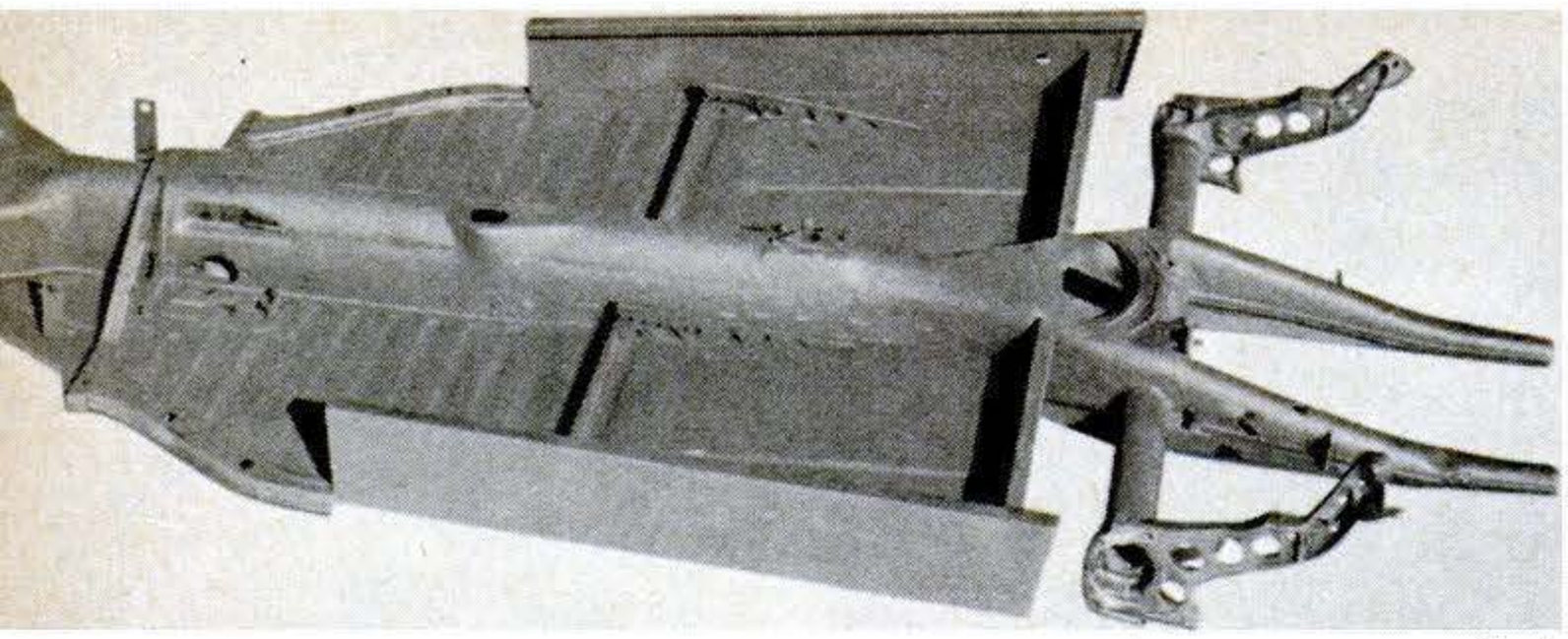


Smooth, flat underside of VW chassis can go over ridged terrain without tearing anything loose.

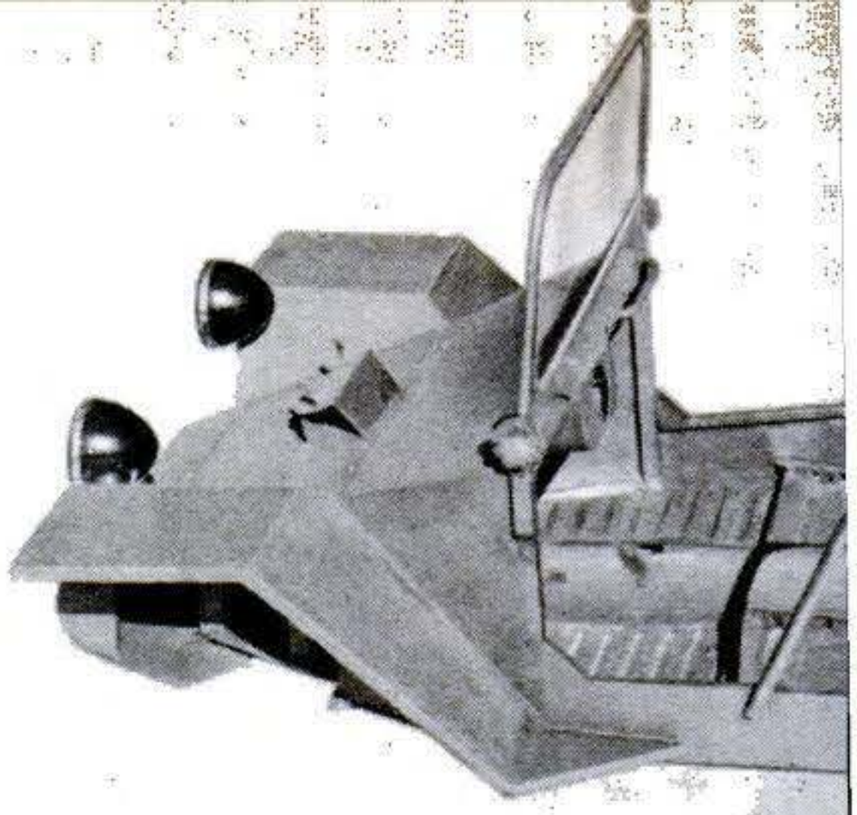
With standard VW suspension, Manx accommodates itself to terrain. Not stiffly sprung, the car is more surefooted than an FWD, can go faster, yet . . .



. . . It's sturdy enough to take this punishment. Engine in rear puts weight where it's needed when uphill going is rough. Undercoating is recommended.



Sportster requires extensive modifications on rear of VW chassis. This has been done on EMPI kit. Most wrecking yards guarantee engine and running gear.



This is the EMPI deluxe kit, ready for installation of salvaged VW components, accessories. Suitable '63 and '64 salvage VWs sell for average of $300.

the Sportster are almost identical, and either will do anything the other will, each has its own character.

The Sportster has an all-steel body welded up of brake-formed panels with bolt-on fenders. It's built to take a lot of tough use and abuse. Its starkly functional, utilitarian character has made it a great favorite with outdoorsmen, hunters, and ranchers.

The Manx is every bit as functional, but its sleeker, one-piece molded-fiberglass body makes it a favorite of the dune-buggy crowd. Here its racier looks, and its ready adaptability to "individualizing" with custom interiors and paint jobs, make it a standout. Wives consider it "cute" and use it as a runabout.

The performance. What these peanut-powered poppers can do has to be experienced to be believed. They'll go anywhere a four-wheel-drive vehicle will go, with twice the comfort, almost twice the speed, and less than half the cost of a typical FWD.

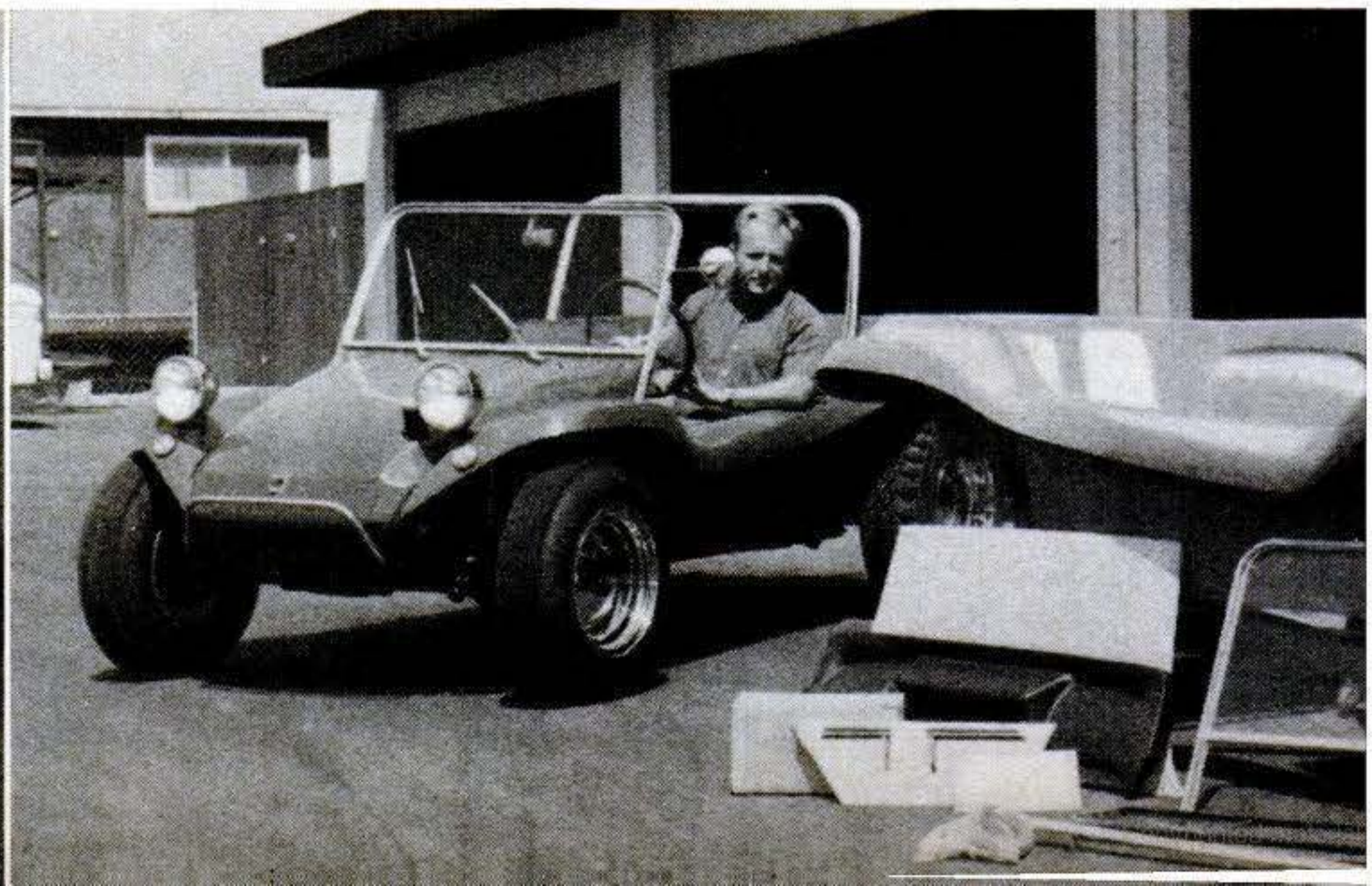
Where a big, heavy FWD will bull and tear its way through, a Sportster or a Manx will run right by it and over the top. And that includes even the FWDs with souped-up V-8 engine conversions. The secret is in the fun cars' overall lightness, the concentration of engine weight over the rear drive wheels, and the tires. The tires—and tire pressure—are especially important on these cars.

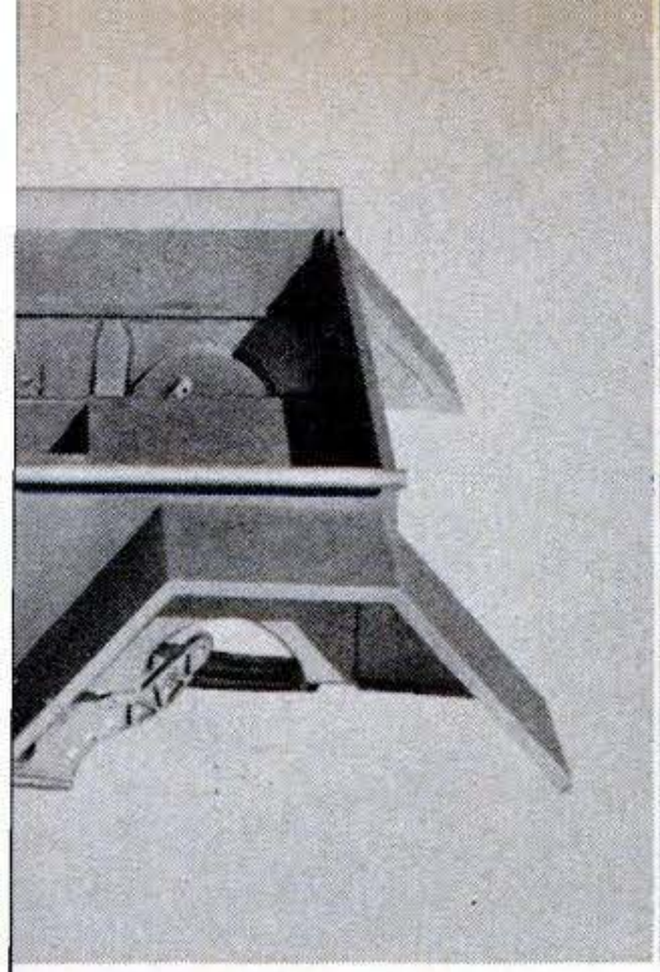
For a good all-around set—one that will work equally well off the road or on the highway—on the front, most owners prefer 7.50-by-14 passenger-car tires mounted on specially built seven-inch-wide rims on VW centers. At the rear, they use 9.15-by-15 mud-and-snow tires on eight-inch-wide rims. In most cases, the same size tires with regular road tread will do just as well on the rear.

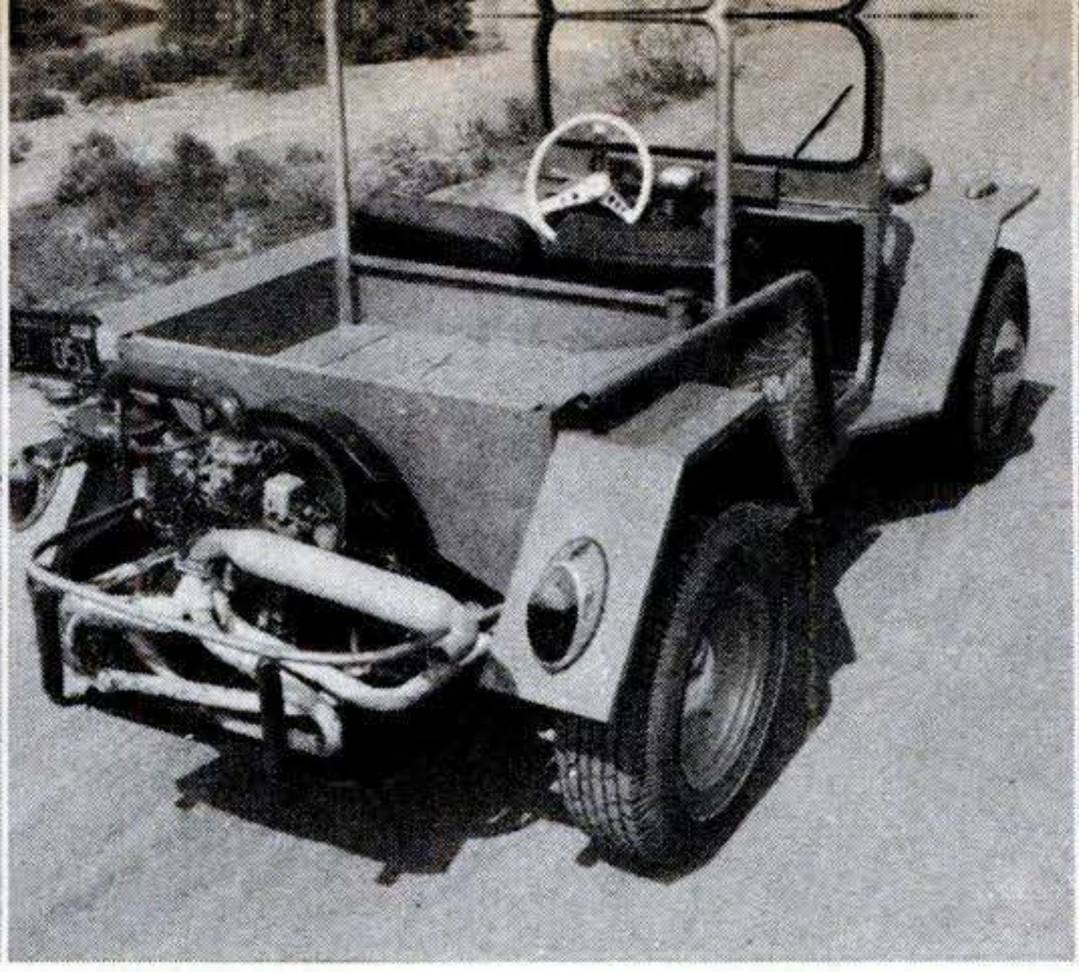
For competition, the same front tires are used, but much larger tires and rims are

Manx bodies are molded, laminated fiberglass, colored in manufacturing process. Torsion bars in VW suspension are unmodified, so ride is semifirm.

Finished product, in which builder Meyers poses, was made from "B" kit teamed with VW parts. The Manx has sporty, appealing lines.







Sportster fenders are reinforced with angle iron to support a good-size man. Windshield folds flat. Wheelbase is 82.5 inches; on Manx, only 80 inches.

Manx plastic dash carries stock VW speedometer, ignition, light, wiper switches. Steering wheel and front bumper on this car are extra-cost accessories.

used on the rear. Most owners take a huge "sand-service" tire and with a grooving iron rework it to their liking. Lately, several have been having good luck with Goodyear's new Terra-Tire. These monsters are 31-by-15.50-15 and they mount on 14-inch-wide rims. Of course, it takes more than 36 or 40 hp. to pull them. Owners of these usually resort to hot-rodding procedures to get the necessary beef. Incidentally, just one pound of air pressure is all it takes in the big ones.

Out on the highway or around town, both cars are a delight to drive. With the stock engine, they have a top speed of about 70 m.p.h., but because of their light weight (about 1,100 pounds, wet), acceleration is greatly improved over that of a stock VW. So is gas mileage. Most owners who use them a lot on the road have convertible canvas tops made for them.

Handling characteristics are similar to those of a VW sedan, but with far less final oversteer, and a much wider band of neutral steer. Steering is quick—2.6 turns between locks. The overall impression is that handling is equal to that of most sports cars.

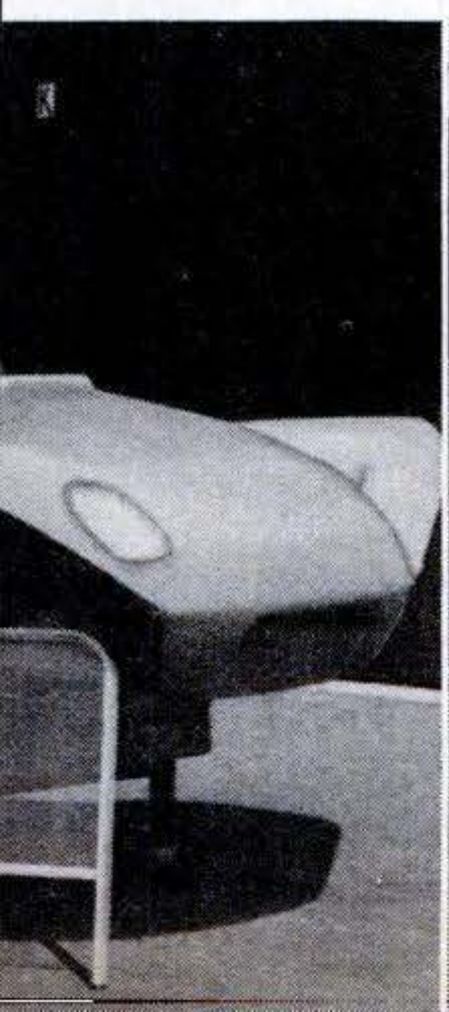
You don't believe it? Well, the California state slalom champion campaigns in a Corvair-powered Manx that usually, besides winning its class, sets fast-time-of-the-day *overall.* Another Corvair-powered Manx won its class at this year's tough Pikes Peak Hill climb in Colorado.

A Manx made the fastest time ever recorded in the 1966 Jeep-O-Rama, an annual event held near Colorado Springs and previously open to FWDs only.

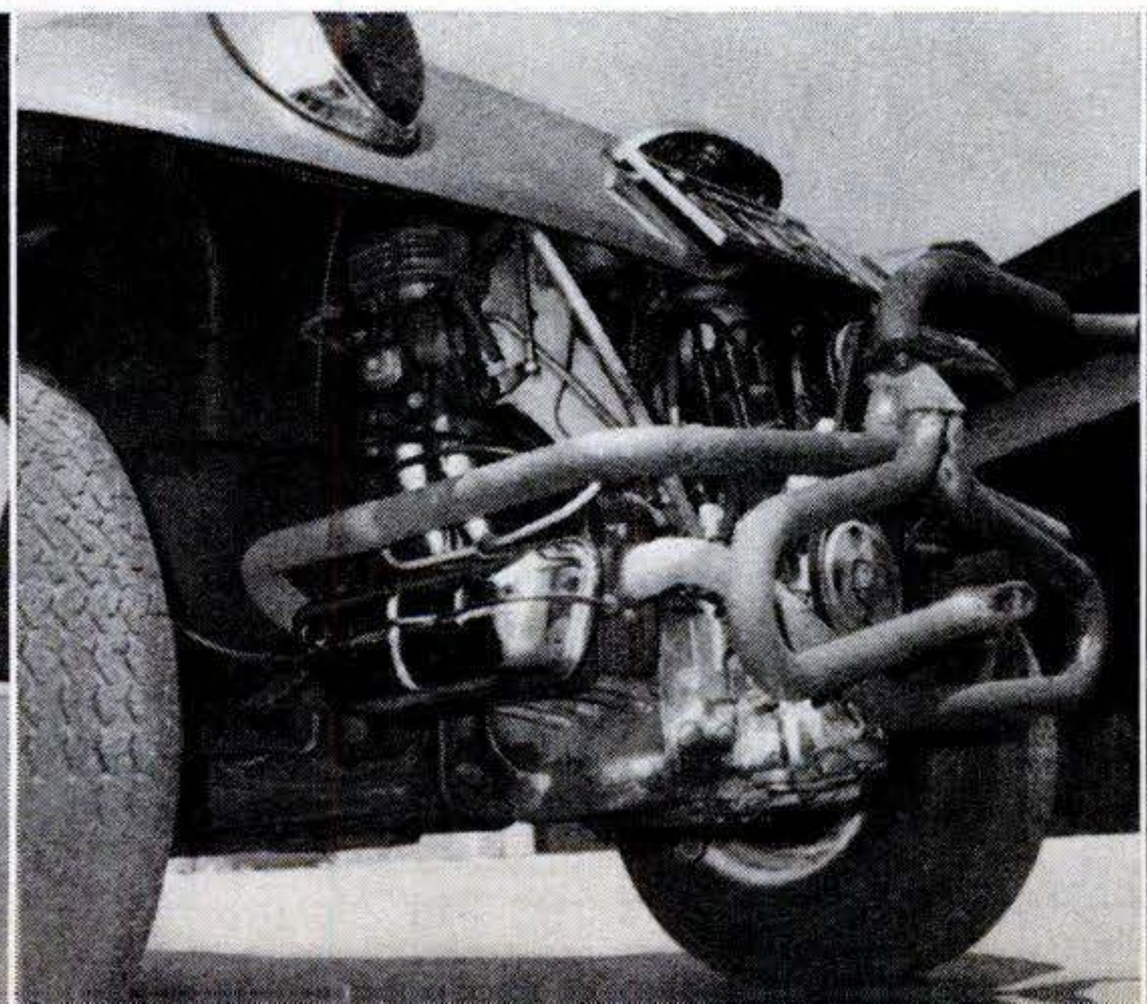
Buying a kit. Both Manx and Sportster kits come in several ways. I've seen both being assembled and can vouch for the simplicity—when the illustrated, easy-to-understand instructions are closely followed.

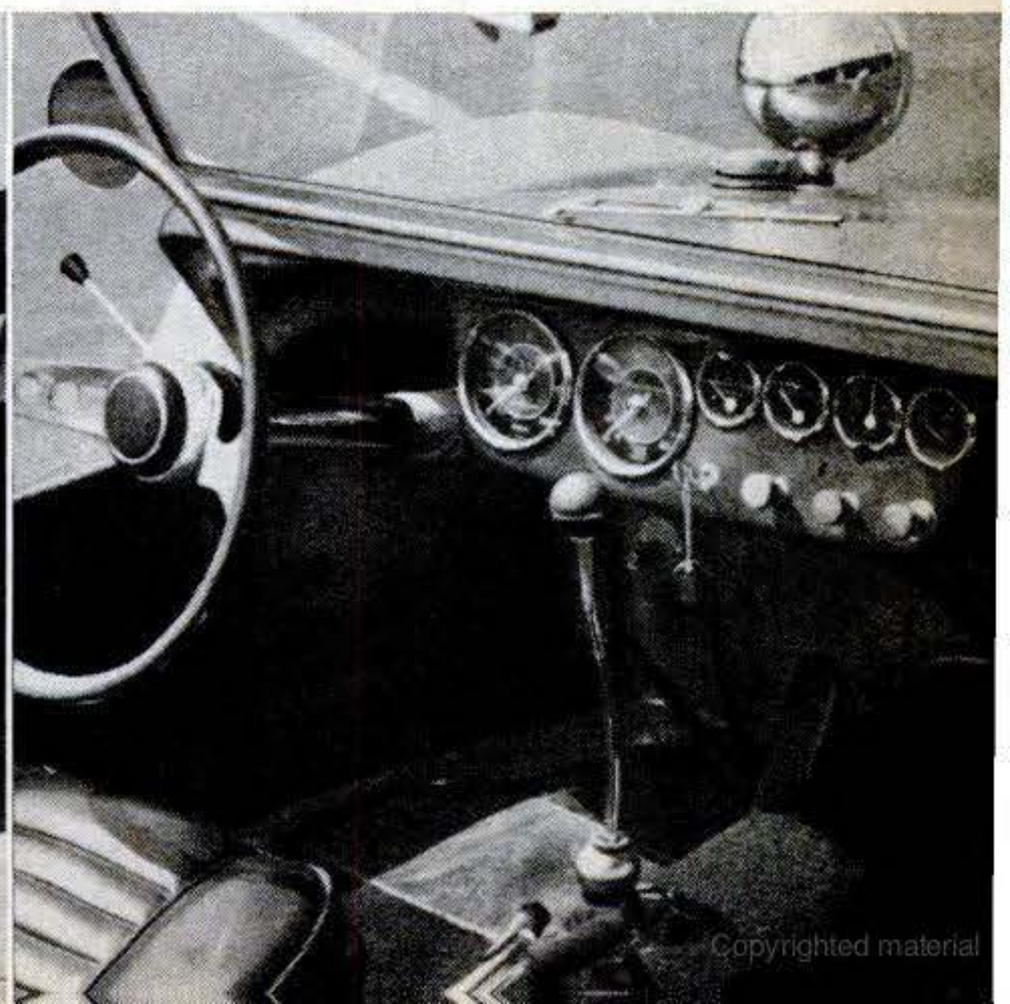
The Sportster can be ordered six ways,

[Continued on page 202]



Porsche 90-hp. engine raises top speed to 115 m.p.h. Street-use tires carry 10-12 p.s.i. front, 14-16 rear. Off-road, they're dropped to four all around.





Porsche instruments, upholstery, carpet customize this Manx. Air shocks vary height—'way up for off-road, halfway for street, clear down for slaloms.

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Crazy Computer Built Just for Fun

It's called the Forget-Me-Not Computer, and its heart is a seven-foot-tall bamboo elephant – the Peripheral Pachyderm – because, as everyone knows, elephants never forget. This spoof on modern electronic brains was created by Rowland Emett (above), a leading British cartoonist, at the invitation of the Honeywell Corp. Nope, the three-section machine can't really solve problems. But, as it merrily spins, hums, twirls, and beeps, the device points up the complexity of real computers, and illustrates how processed information really moves within the various components. Honeywell plans to take Forget-Me-Not on a nationwide tour later this year.

Deep within the Peripheral Pachyderm is a set of tiny minds—the computer's memory. They are controlled by the main brain. A stream of water washes unworthy thoughts (and errors) down the "brain drain."

Smaller bamboo elephant to the left of the Peripheral Pachyderm is in charge of making and reading punched cards. New cards are punched by electric woodpeckers; old cards are read by a roving eye.

Biggest window in the world

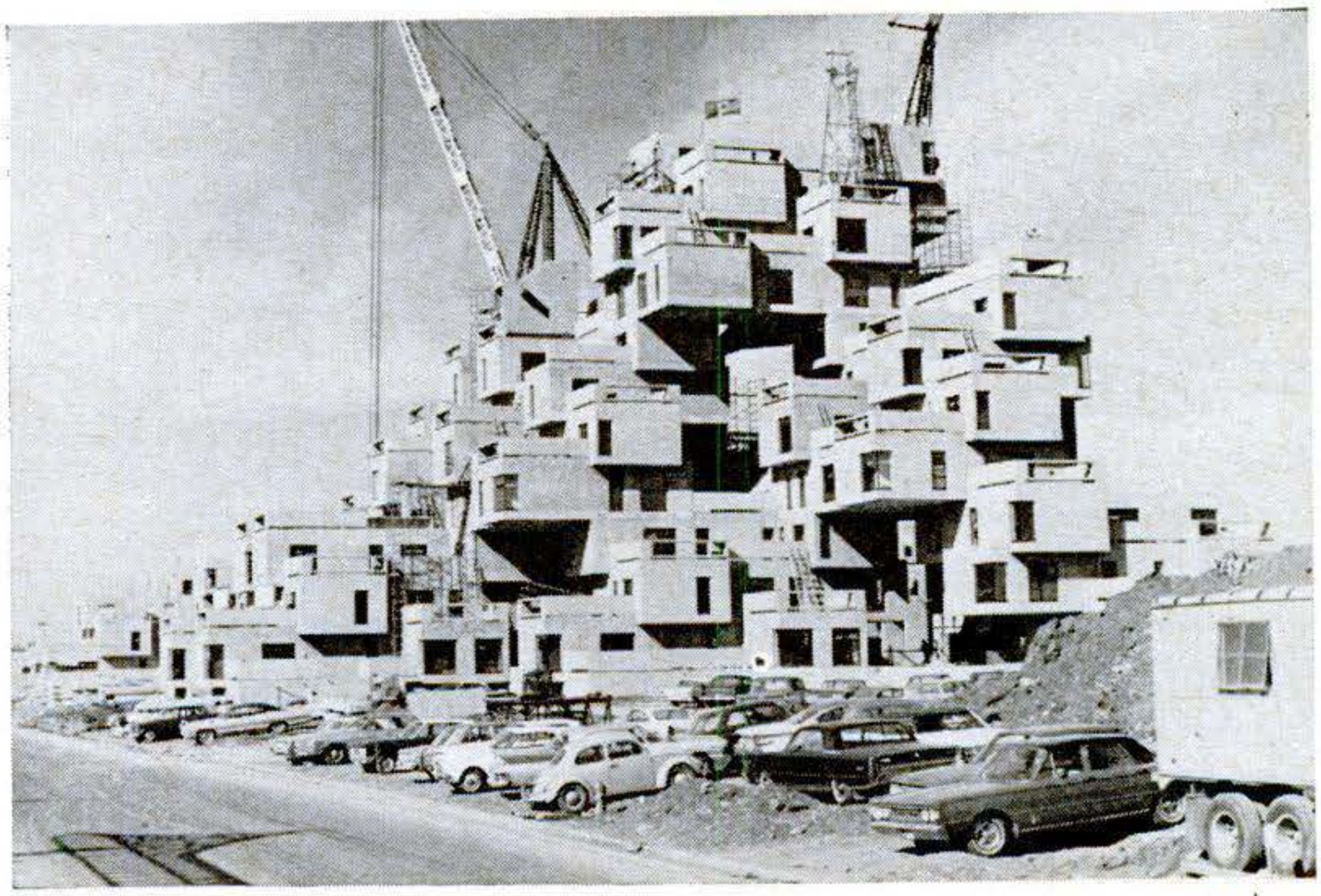
Fans seated in the Laurel, Md., racetrack grandstand are now protected from bad weather by the world's largest window—nearly 1,000 feet long. The glass is ¾-inch armorplate and weighs approximately 150 tons. The huge window was built by Pilkington Glass Co. of St. Helens, England. It is held in place by a "suspended assembly" system.

Truck backs into plane to unload

Transfer of a cargo container from truck to plane goes fast in this demonstration—the trailer is simply backed into the fold-away rear of a Lockheed fanjet freighter. Using the system, cargo in prepacked containers can be unloaded directly from the truck, eliminating transfer equipment. The demonstration was staged for airline executives at the Cleveland airport.

Montreal fair has pyramid of homes

Habitat '67 is a cluster of 158 houses stacked in pyramid fashion to house some employees of Expo '67—the Montreal World's Fair, which opens in April. The precast-concrete homes range from one to four bedrooms in size, and each has its own landscaped garden, shielded from neighbors. The structure is 120 feet tall and 900 feet long. Cost: $10 million.



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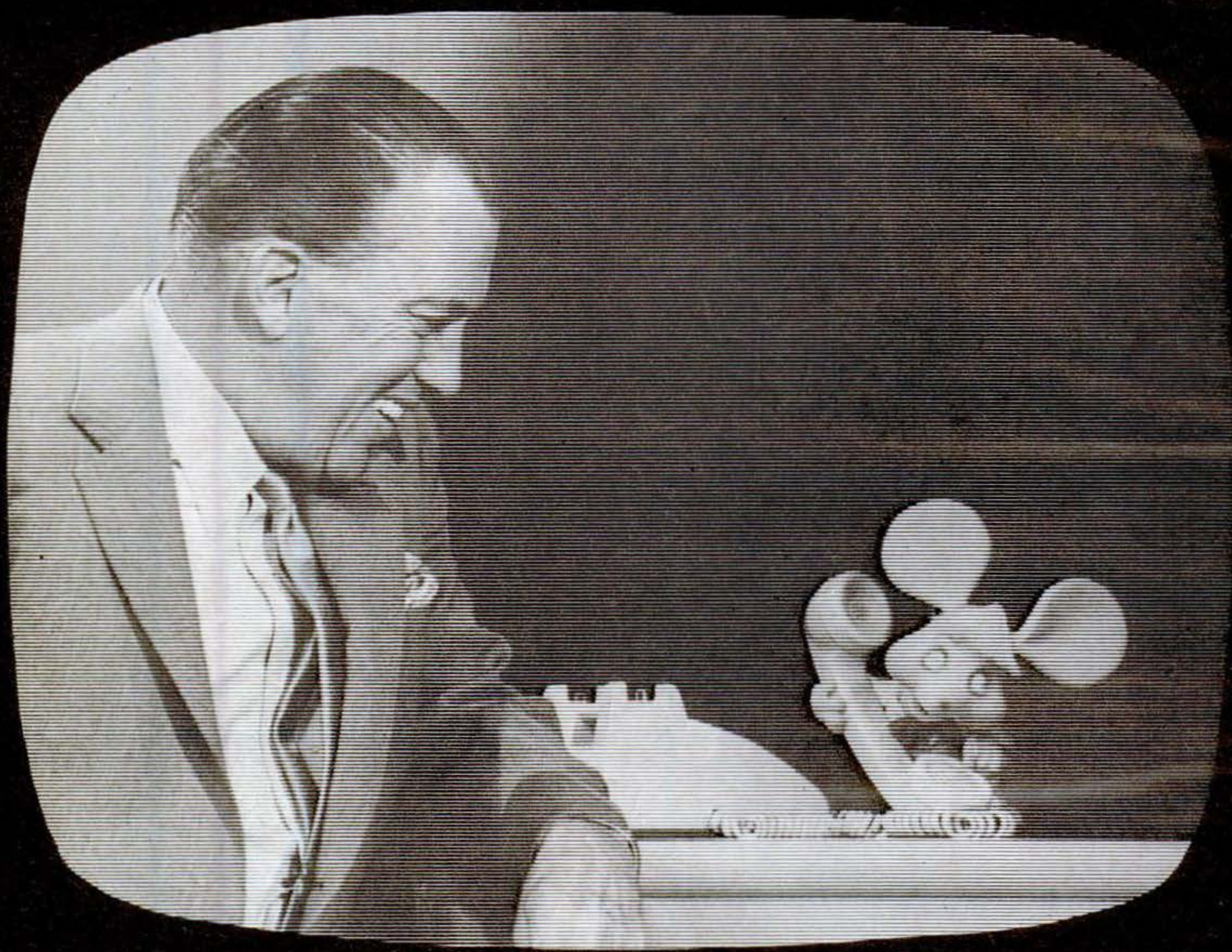
How do they do it?

The Tricky Mouse on the Ed



PS goes behind the scenes to show you how Topo Gigio does those lifelike stunts on your TV screen

By HERBERT SHULDINER

There have been innumerable mousetraps patented by the U.S. Patent Office—but only one "mouse" has been awarded a patent number all his own.

The unique distinction belongs to Topo Gigio, the tricky little Italian mouse that has delighted millions on the Ed Sullivan TV Show—and indeed all over the world. But as much as Topo amuses, he also puzzles viewers as to how he can perform in such a lifelike manner. "The first thing everyone wants to know," Sullivan says, "is how does Topo Gigio work."

How does he walk up Ed Sullivan's arm, or lie down in a bed and pull the covers over himself? How does Topo roll his eyes and curl his toes?

To get the answers to these questions, POPULAR SCIENCE went behind the scenes of

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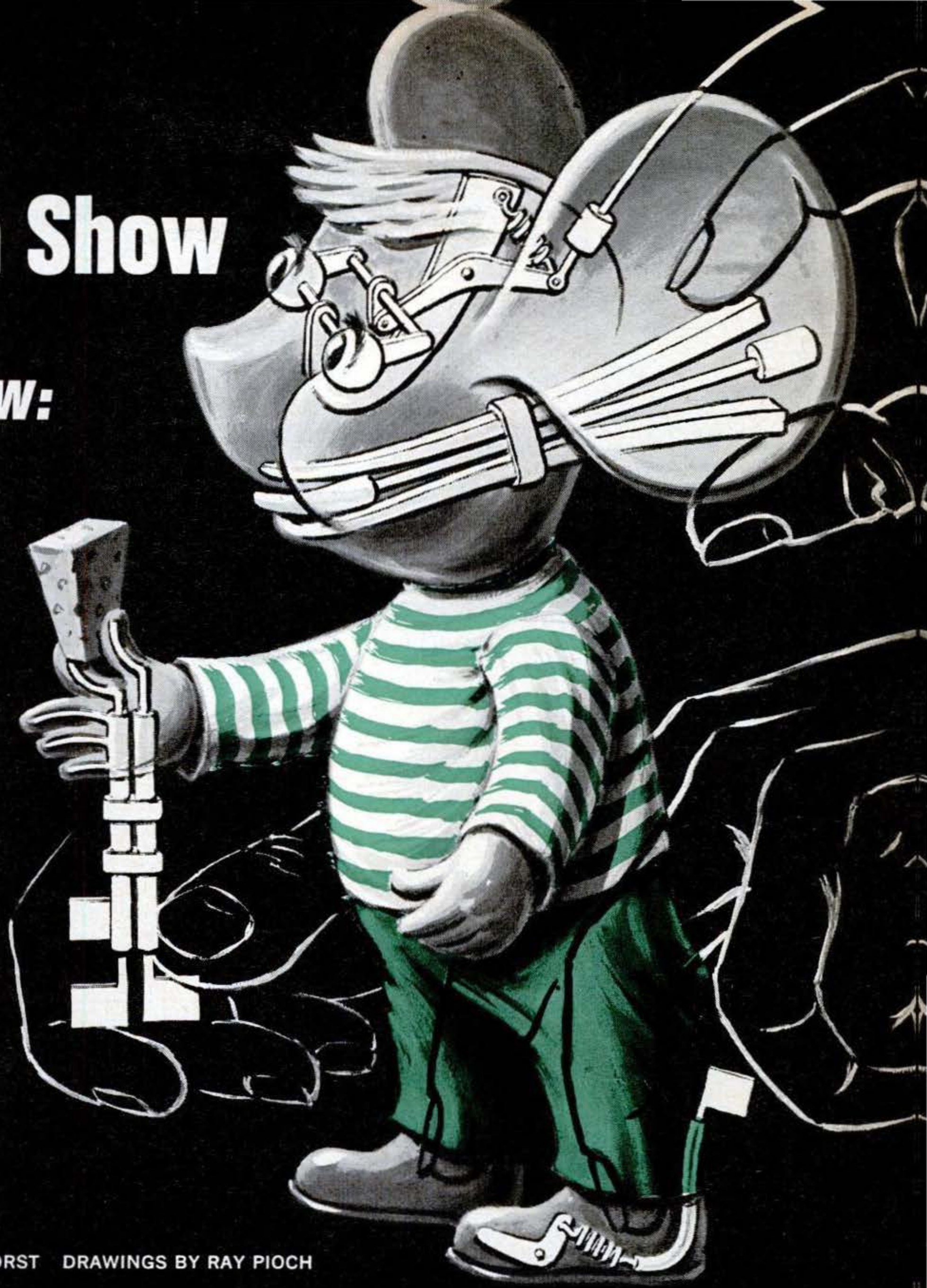
Sullivan Show

Here's how:

It takes at least two people to operate Topo Gigio. One puppeteer operates the mouse's legs and the head and another the arms. The rods that move the mouth resemble a spring-type clothespin and the foam gives easily for simulating speech and altering facial expressions. A small cable attached to a spring-loaded lever enables the puppeteer to make Topo roll his eyes and a similar device enables him to curl his toes. The mouse's ears are just flexible and are made to wiggle by shaking the tiny animal's head.



PHOTOS BY ROBERT D. BORST DRAWINGS BY RAY PIOCH

the Ed Sullivan Show at a CBS studio in New York to find out just what Topo is and how he can almost make you forget that he's just a make-believe mouse.

The secret behind Topo Gigio is a vivacious Italian puppeteer, Madame Maria Perego, who created the little mouse puppet out of flexible urethane foam. She hit on foam after experimenting with papier-maché, first, and then plaster. The use of soft foam eliminates the need to make cuts for the mouth that most hard-surfaced puppets require.

Madame Perego manipulates Topo Gigio —which is Little Louie the Mouse in Italian— by placing two fingers on her left hand in each of Topo's legs. She operates the mouth and eyes with her right hand. The rods that operate the mouth are almost like a spring clothespin. Another puppeteer operates the arms—manipulating the rods for the fingers and otherwise using the arms to emphasize the mouse's "lines." Sometimes a third

Continued

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Antics are so convincing, it's hard to tell Topo isn't real

Puppeteer Maria Perego and her associate are barely visible in the top photo as Topo Gigio climbs up Ed Sullivan's arm during a rehearsal. During the show, when the puppeteers don masks, they become invisible to TV camera lens.

puppeteer is used to work Topo for other effects.

How do puppeteers do all this and yet not show up on your screen? It's like the black cat in the coal bin. It's there, but you can't see it. Madame Perego and her associates dress in black velvet robes and gloves—even wear black hoods over their heads. They work in front of a black background and the lights are focused directly on Topo Gigio and Sullivan. Stray light on the puppeteers' black velvet robes isn't picked up by the television cameras.

Topo Gigio's voice, which has been supplied by many actors, is fed into a mike located offstage.

Madame Perego and her associates for the most part don't even look at Topo while they put him through his paces. They look at a monitor in front of them to see how it is coming over on the screen. Even though Madame Perego doesn't understand English, she is still able to use Topo's little body to emphasize the humorous lines read for the mouse by using the monitor and intuitively feeling what is being said.

The result is so lifelike that Sullivan says, "Even after all the times I've worked with that darn little mouse, I sometimes forget he isn't real." PS

Topo's voice is supplied here by actor Keith Alexander who reads script and watches Topo Gigio and Ed Sullivan perform on a TV monitor in front of him.

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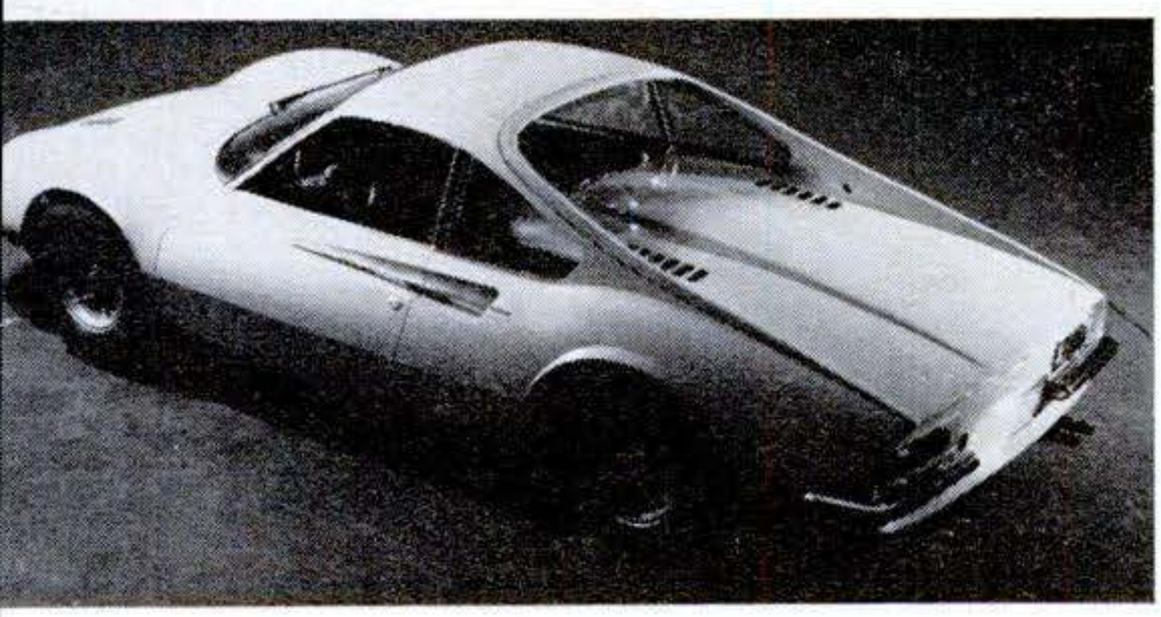
World's largest ship (209,000 tons) is a whale of a tanker

The Idemitsu Maru is a new oil tanker built by Japan's Ishikawajima-Harima Heavy Industries Co. in Yokohama. The huge vessel is 1,122 feet long, 163 feet wide, and could carry the equivalent of 1.3 billion bottles of Coca Cola, but actually will haul oil between Kuwait and the Orient. It gets a cruising speed of 6.5 knots from a 33,000-hp. reheat steam turbine.



New Ferrari has midships engine

The Dino GT Berlinetta is the first Ferrari with a midships power plant, just as in the famed Italian company's racing cars. The car has a V-12 engine with a single overhead camshaft per bank, and three Weber carburetors. Its power output is 320 hp. at 7,500 r.p.m. Access to the engine is through the extremely wide hood, which can be lifted up to the rear window.

Outboard powers ash cans

This strange-looking British craft is made of three ash cans joined together by a small wooden platform. Its purpose is to test the ruggedness of a U.S.-made 20-horsepower outboard motor. Pilot of the Bingcraft, shown above crossing a lake, is Dennis Mansfield, special-products-division manager of South Western Marine Factors, Maidenhead, England.

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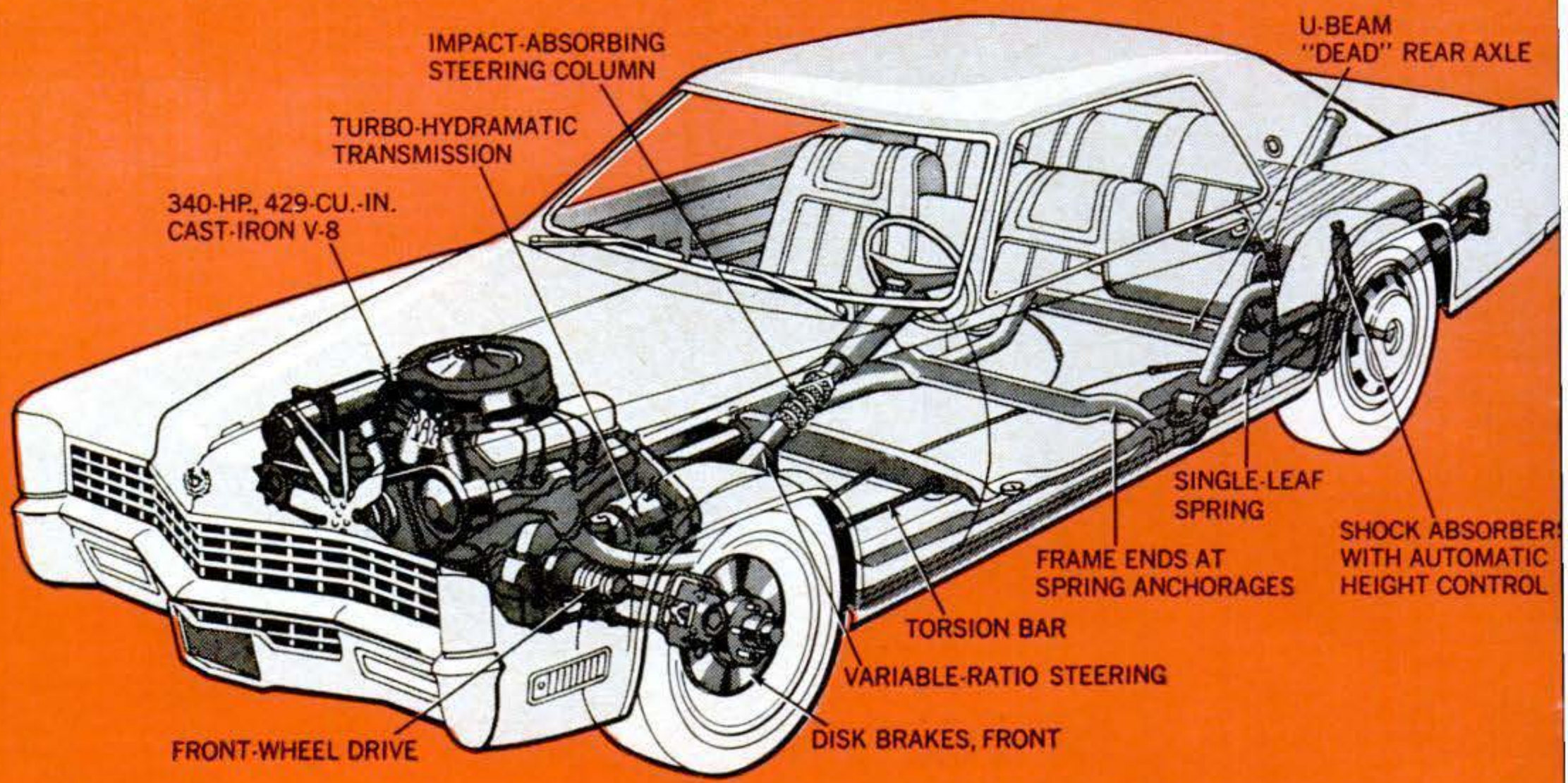
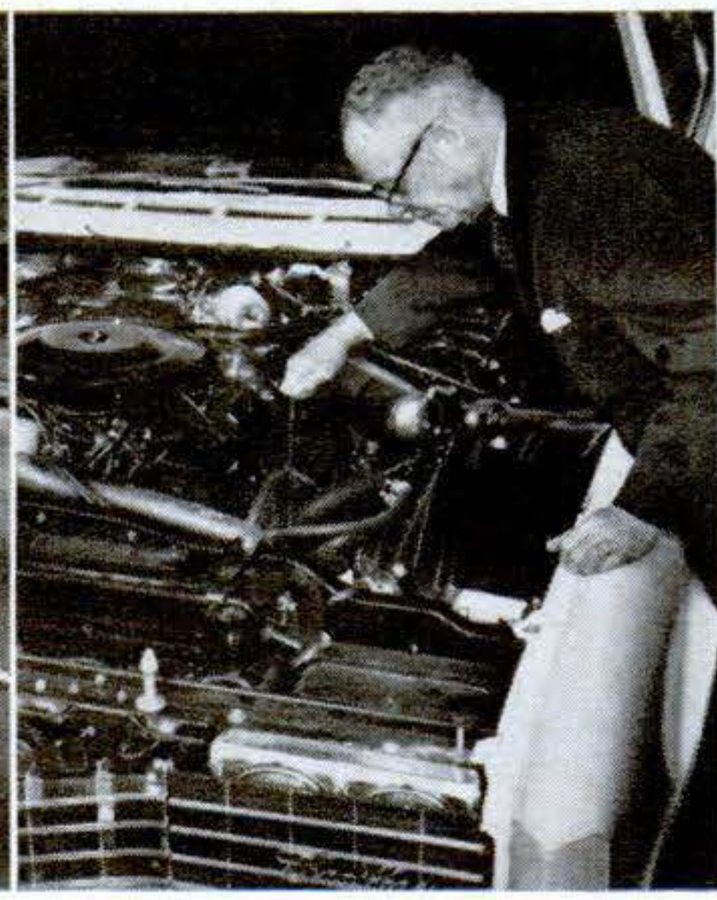
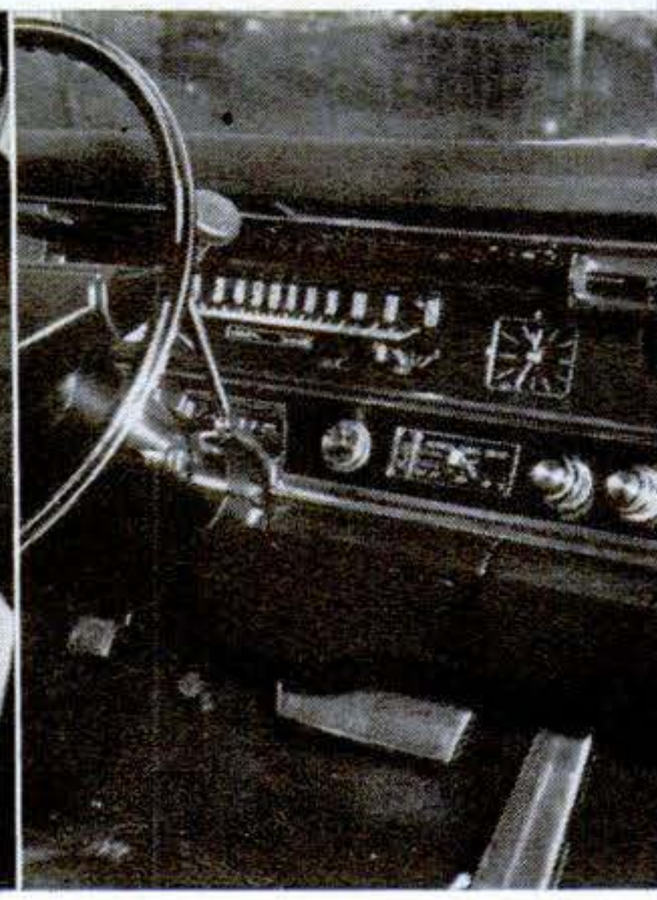
If YOU had $1,000,000... which car would



Cadillac Eldorado with its long hood and short deck is an eye-stopper. The world's only car with a combination of front-wheel drive, variable-ratio power steering, and automatic leveling as standard, it has a wheelbase of 120 inches, overall length of 221 It weighs 4,647 pounds. Height is 53.3 inches. I is brand new in the Cadillac '67 line. With powe on the front wheels, it has a completely flat floor

"If I Had a Million Dollars..





Stability on the road, even with brisk quartering winds, makes it kin to other front-drive cars, notably those of Europe. Putting the driving torque through the front wheels permits use of simple, single-leaf rear springs. Despite its weight and size, car proved to be exceptionally agile, even in dense city traffic.

Engine is that of the standard Cadillac, rated at 340 hp. The transmission rests alongside it and is linked directly to the differential. With all that machinery up front, mechanical repair might prove a problem —who cares, with a million?

Automation still requires button-pushing, and driver Francis had to devote 30 minutes to a cockpit checkout. "If," he reported, "I had any bleats on this job, it was only on sparse headroom; inside, finger-catching door releases."

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OU buy? A Caddy? Rolls? Mercedes?

I'D BUY A CADILLAC"

BY DEVON FRANCIS

Come now, there's no argument! A Cadillac is the world's finest automobile, especially in the Eldorado front-wheel-drive version. Like the Olds Toronado, it takes corners like on rails.

I drove the plushiest version with all the extras ($8,000-odd), and the Cadillac people had to threaten to sue me to get it back.

For pure luxury, this car can't be matched. If only I had a million dollars! Let's start with the ride. It's superb. Power? I squealed rubber on takeoff. Automatic leveling keeps the lights on the road regardless of load.

Practically everything else is automatic, too. Take the headlights again. Flip a switch, and they go on at dusk and off at dawn by themselves. For years Caddy has had cornering lights that shoot out to light your way into a turn. It is the only American car with variable-ratio steering—sheer delight when parking and just like regular power steering on the highway.

Start the engine and slip the selector lever into Drive, and the parking brake releases—automatically. Flip a toggle switch, and the doors lock. Thumb a dial to the temperature you want, and the Climate Control keeps it there summer and winter plus or minus one degree. Dial the speed you want, and the car maintains it up hill and down dale. Flick a switch, and seat warmers instantly take the chill off the upholstery—and go off automatically when the heater floods the car with warmth.

Wait! I'm not through! How about Caddy's tilting-telescoping steering wheel, rear-window defogger, and AM-FM stereo radio? And the car's as quiet as a church.

Mercedes? Rolls-Royce? Humph! PS

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"If I Had a Million Dollars...

Smooth ride, quiet interior are your first impressions. The Silver Shadow is also nimble in traffic, with light steering and wonderful brakes. Power? The factory won't tell—all they say is "enough." Judging by performance, our guess is 285 hp.

Aluminum V-8 and its plumbing are admired by Scott. Ignition of Silver Shadow is fail-safe, with dual contact points. Car also has two separate electrical fuel pumps and four fan belts.

Two-spoke steering wheel is free of horn ring, and speedometer is way off to the left, for the driver's eye alone. Parking brake is hand-operated.

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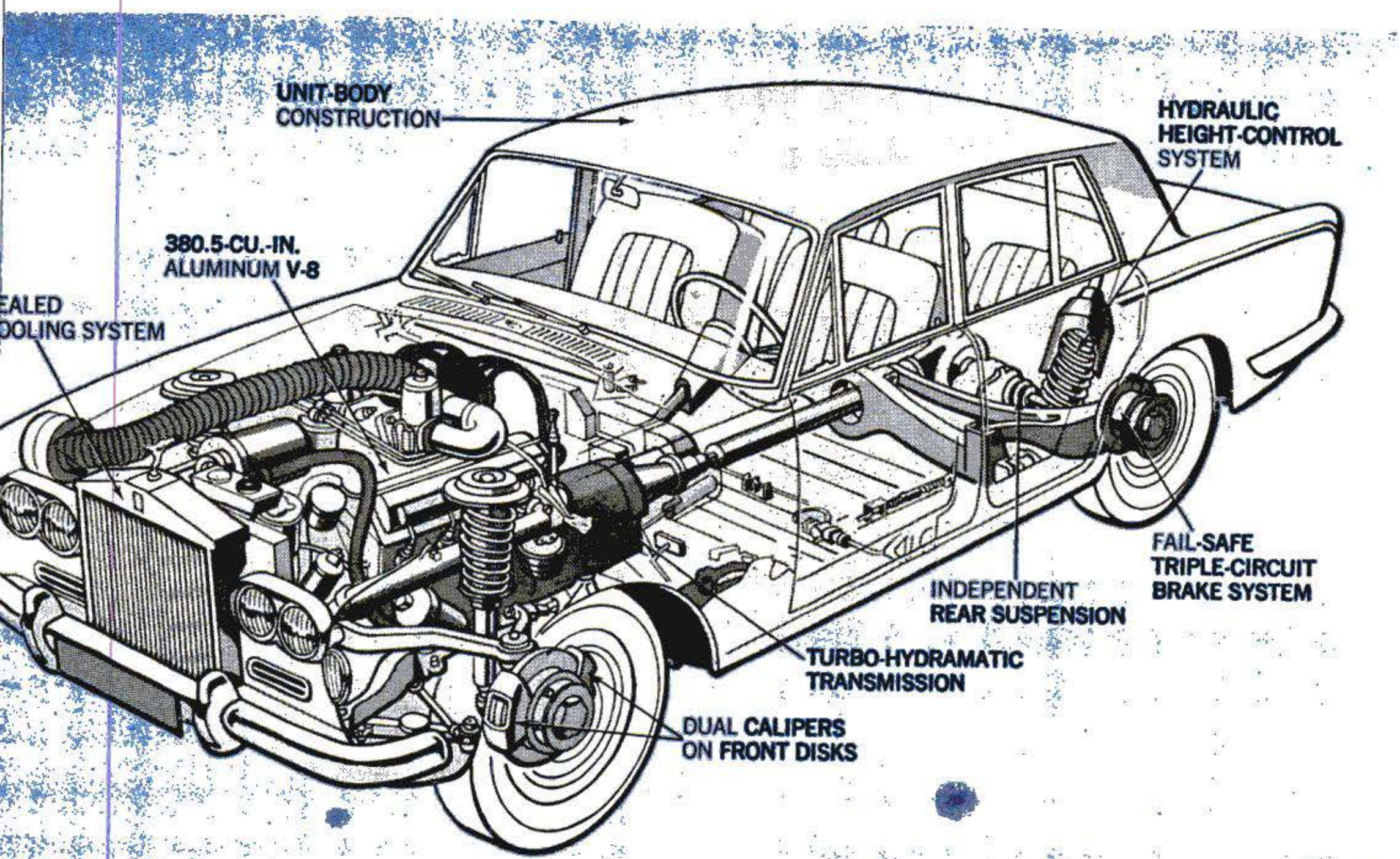

The Silver Shadow departs from Rolls-Royce traditions—but retains "quality in depth."

I'D BUY A ROLLS-ROYCE"

By DAVID SCOTT / *PS European Editor*

Many people think of Rolls-Royces as chauffeur-driven limousines. But the Silver Shadow is a Rolls-Royce for the man who likes to drive. Compared with Queen Elizabeth's Phantom V, it's a compact car.

It has many technical features new to Rolls-Royce, yet it has the same thorough engineering that earned Rolls-Royce its reputation. It also has the same luxury. When you're at the wheel, there's no painted body metal in sight on the interior. Only thick-pile carpeting, genuine leather, and fine wood.

This carriage favored by royalty and oil tycoons was all mine for five days. I soon got used to its many refinements, and I miss them mightily in my Morris.

You, too, would like electric control of the automatic transmission. There are no linkage complications, and you get immediate shifts. You don't look under the hood for oil and water levels. There are warning lights for that. There's also a light that goes on when you're down to three gallons of fuel and a hand-brake light that goes on in case of burned-out stoplights. The rear-window defroster is no hot-air device—electric wires are placed inside the glass.

Compared with the Mercedes 600, the Silver Shadow offers two great advantages: transmission shifts are smoother, and there is no nosedive on braking. The new Rolls is very well behaved, except for some body roll on brisk cornering. The 38-foot turning diameter gives the car excellent maneuverability.

I went to the R-R factory in Crewe to see how they make cars, and there's nothing like it in the world. It's a tireless quest for what I call "quality in depth." It pervades every step of manufacture and assembly. The $19,700 Silver Shadow is built to last, and I would want to keep mine for a long time—like most Rolls owners. PS

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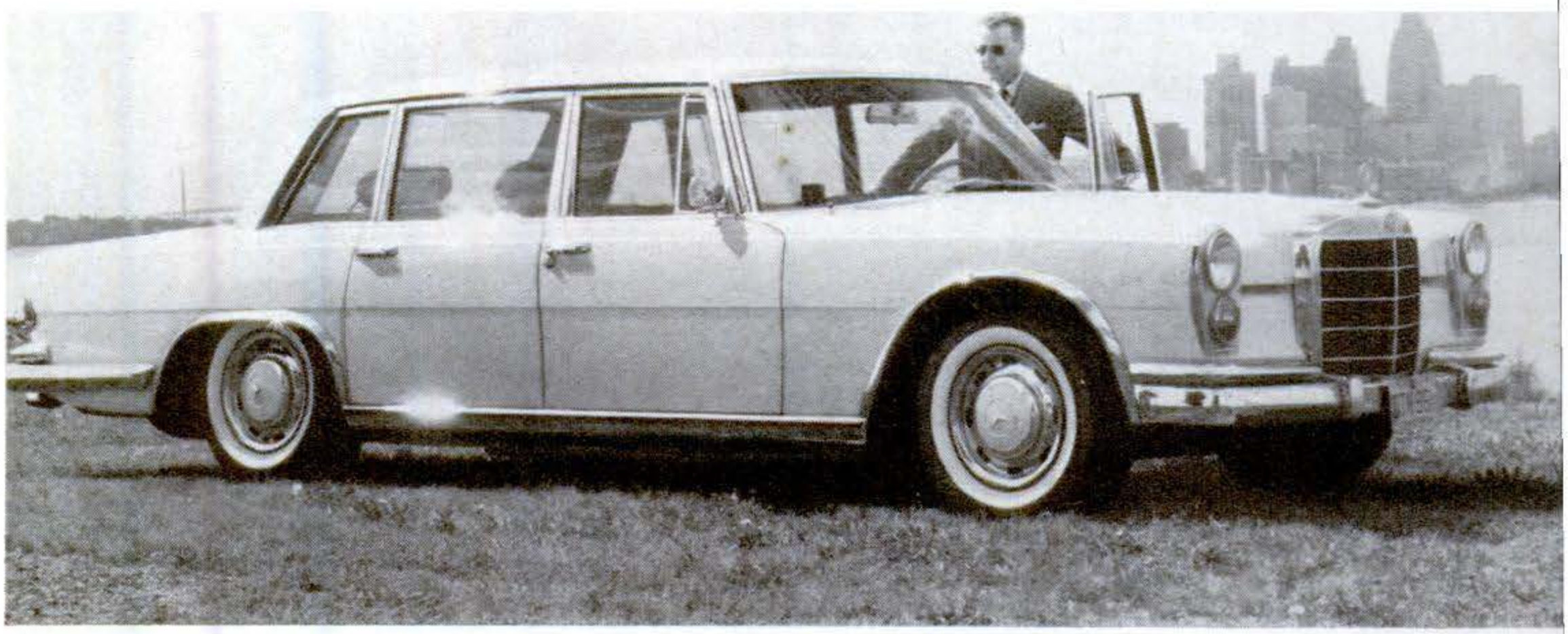


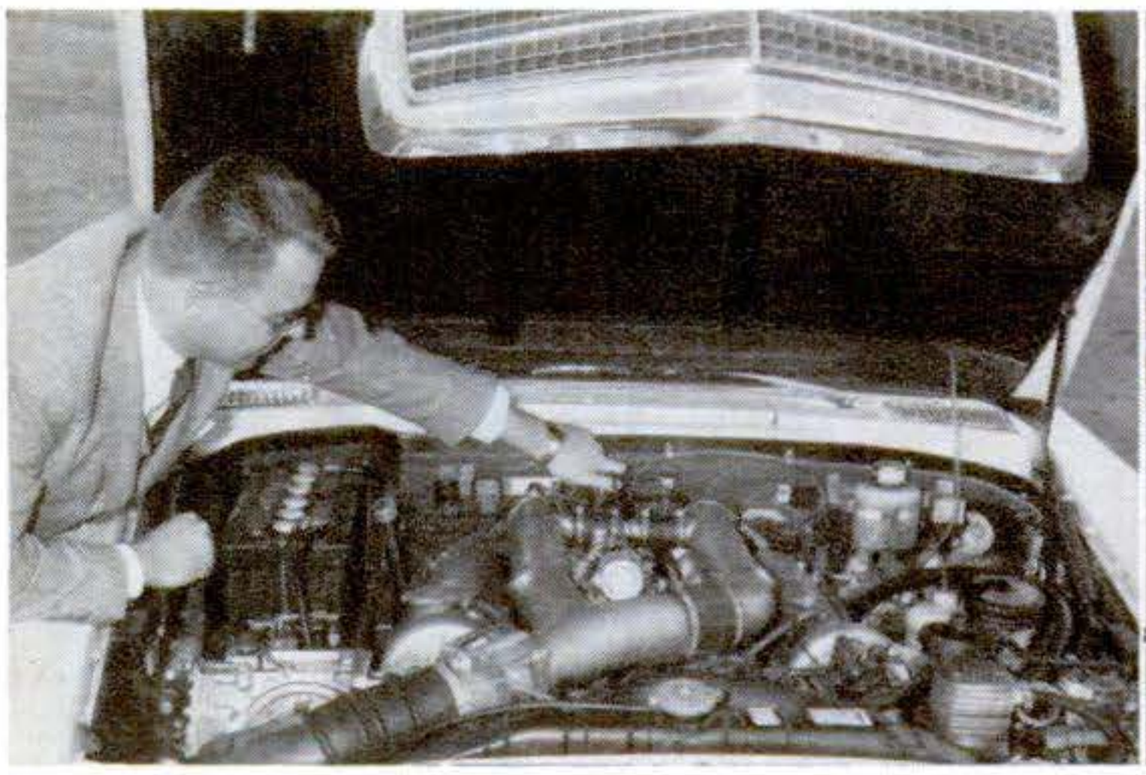
"If I Had a Million Dollars...

By **JAN P. NORBYE** / *PS Automotive Editor*

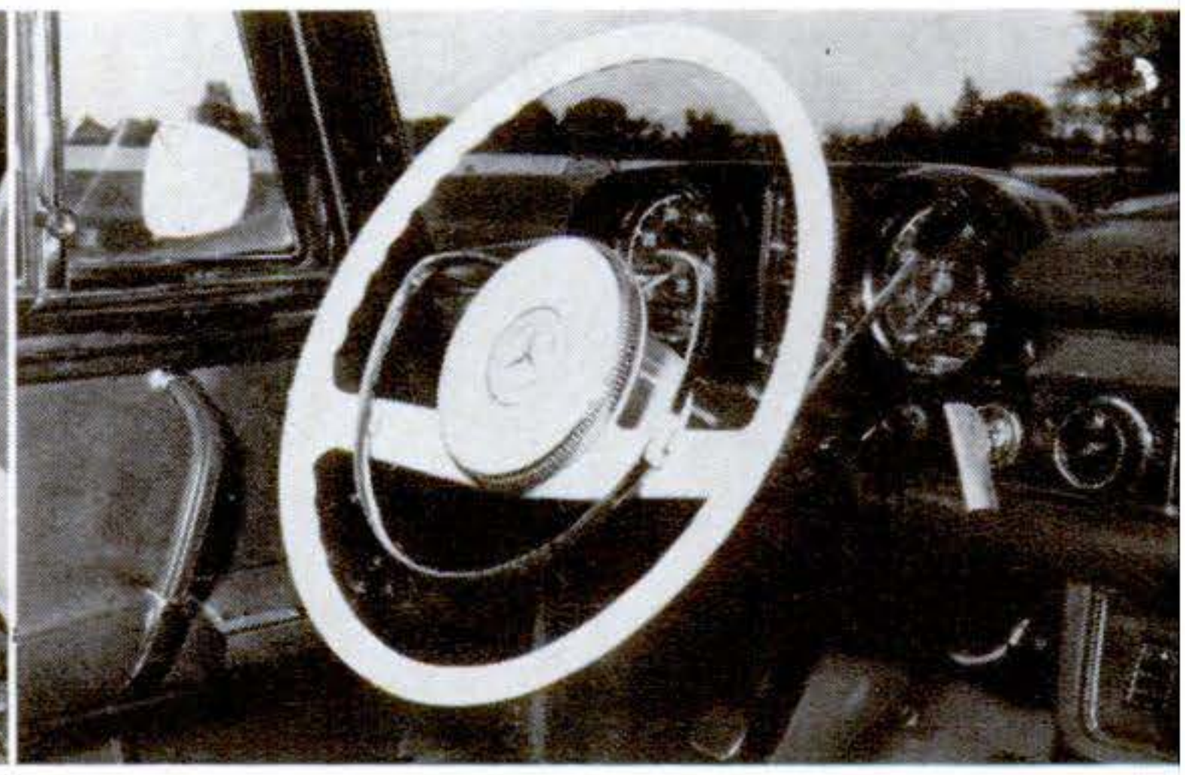
I enjoy driving a superfast, exciting Ferrari. But given a free choice, I'd take the Mercedes 600. This car was designed to be the finest automobile ever built in regular production, regardless of cost. You can tell it's something special before you even get inside. An effortless touch of the handle opens the door. And the door helps shut itself—quietly, with hydraulic power.

Inside, it's the feel of the six-way power seat (even the rear seat is adjustable). It's the lavish use of real wood on the dash. It's the way nothing is loose. You don't even see mismatched joints in rubber moldings. Nothing looks added on; all accessories are built in. The finish is superb.

A look at the drawing will tell you something about the level of engineering in this car. You may be surprised to see that it has air suspension and fuel injection—items



Crowded engine compartment is laid out for good access to units that need maintenance, such as distributor and plugs. Norbye jiggles the throttle, linked to both air valve and injection pump.



First thing you notice is the padded steering-wheel hub—common to all Mercedes cars since '59. Two large dials hold speedometer and tachometer. Gauges are supplemented by warning lights.

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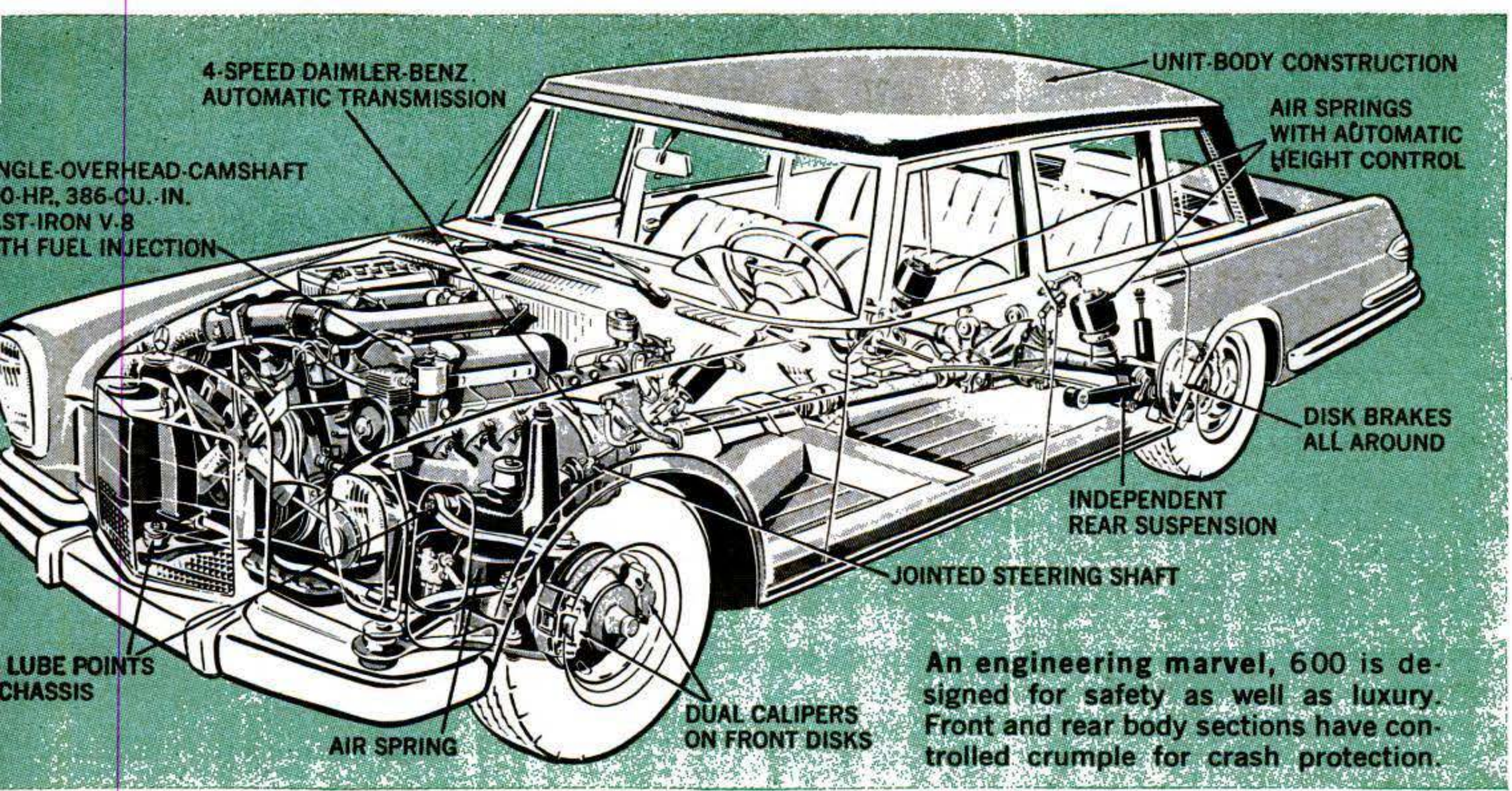


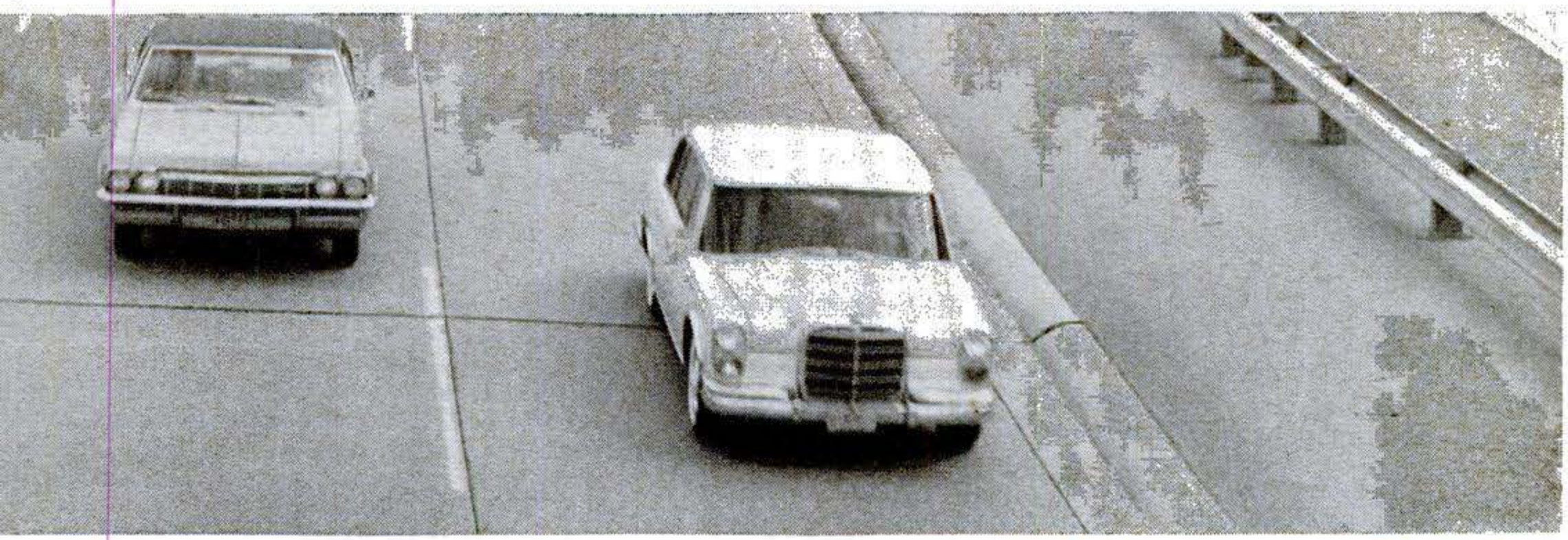
An engineering marvel, 600 is designed for safety as well as luxury. Front and rear body sections have controlled crumple for crash protection.

I'D BUY A MERCEDES 600"

Detroit tried, and dropped. It seems that Mercedes-Benz delights in succeeding, at any cost, where Detroit fails to come up with something at once reliable, salable, and profitable. I put 2,500 miles on the 600. Throughout, everything worked to perfection.

One reason I prefer Mercedes-Benz over Rolls-Royce is the way the Stuttgart factory designs everything for itself—even power steering and automatic transmissions. Rolls-Royce buys its transmissions from General Motors, and its brake system is built under Citroën patents.

If you're a keen driver, you'll like the horn in the 600. For town use, it's not too loud. Flip a switch, and you get a flow-pitch air horn for highway use. Ride too hard? A handle on the steering column adjusts the shock absorbers while you drive. There's no end to its refinements. Even the trunk lid is hydraulically opened and closed. For $21,000, the Mercedes 600 has everything I want in a car. PS



Steady is the word to describe its handling. The 600 doesn't wander in crosswinds, and steering feels the same at 115 m.p.h. as at 75. Despite its locomotive-like weight of 5,425 pounds, it would outdrag the 230-SL in a quarter-mile. Ride is firmer than on U.S.-built luxury cars, noise levels about the same as Cadillac's. Loudest thing in 600 is clicking of injection pump. Clock is absolutely noiseless.

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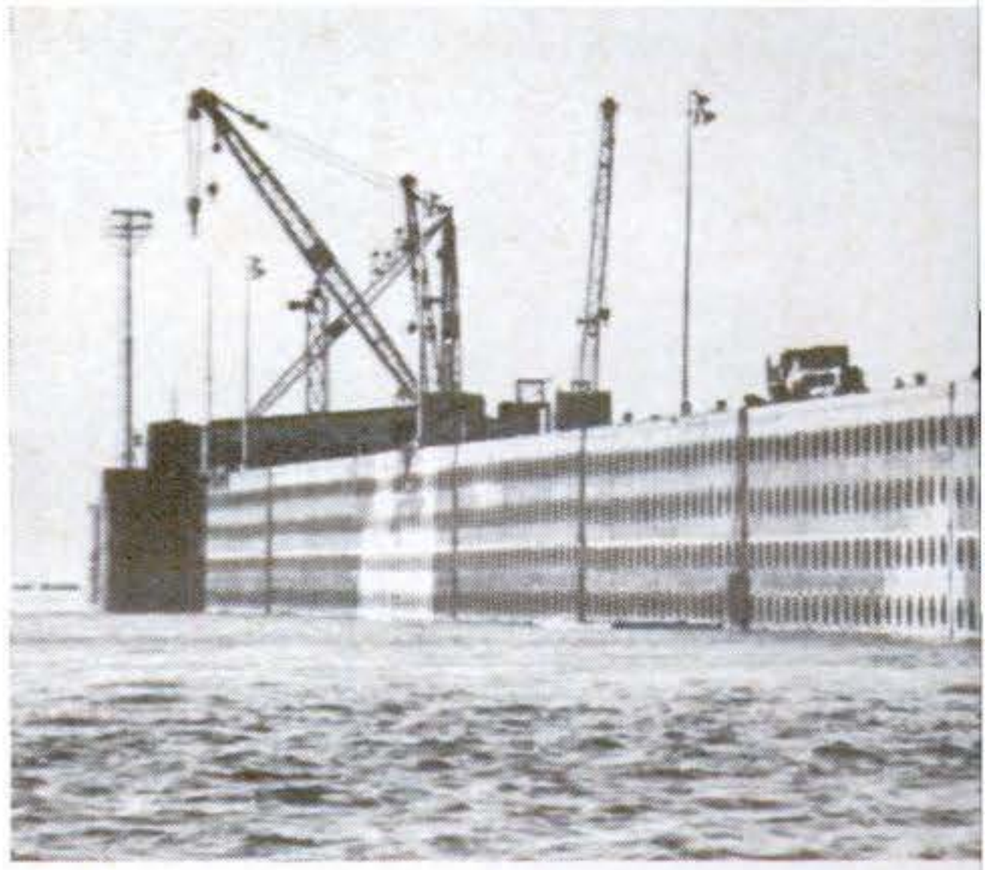
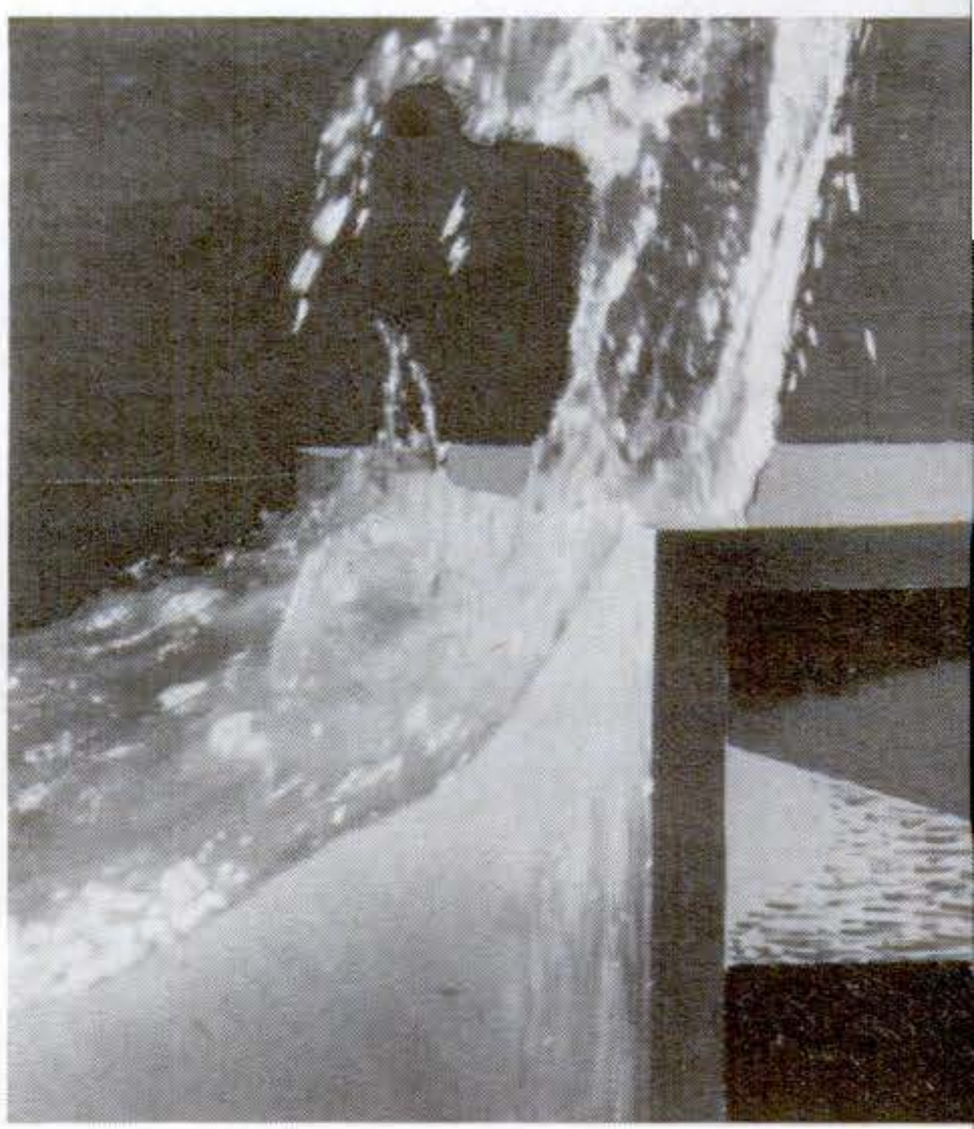
Walls like Swiss cheese tame the fury of the sea

The Dutch boy who put his finger in the dike would be horrified! A Canadian engineer has invented a sea wall that is chock full of holes and it works—to cut down on the damage waves usually inflict on wharfs.

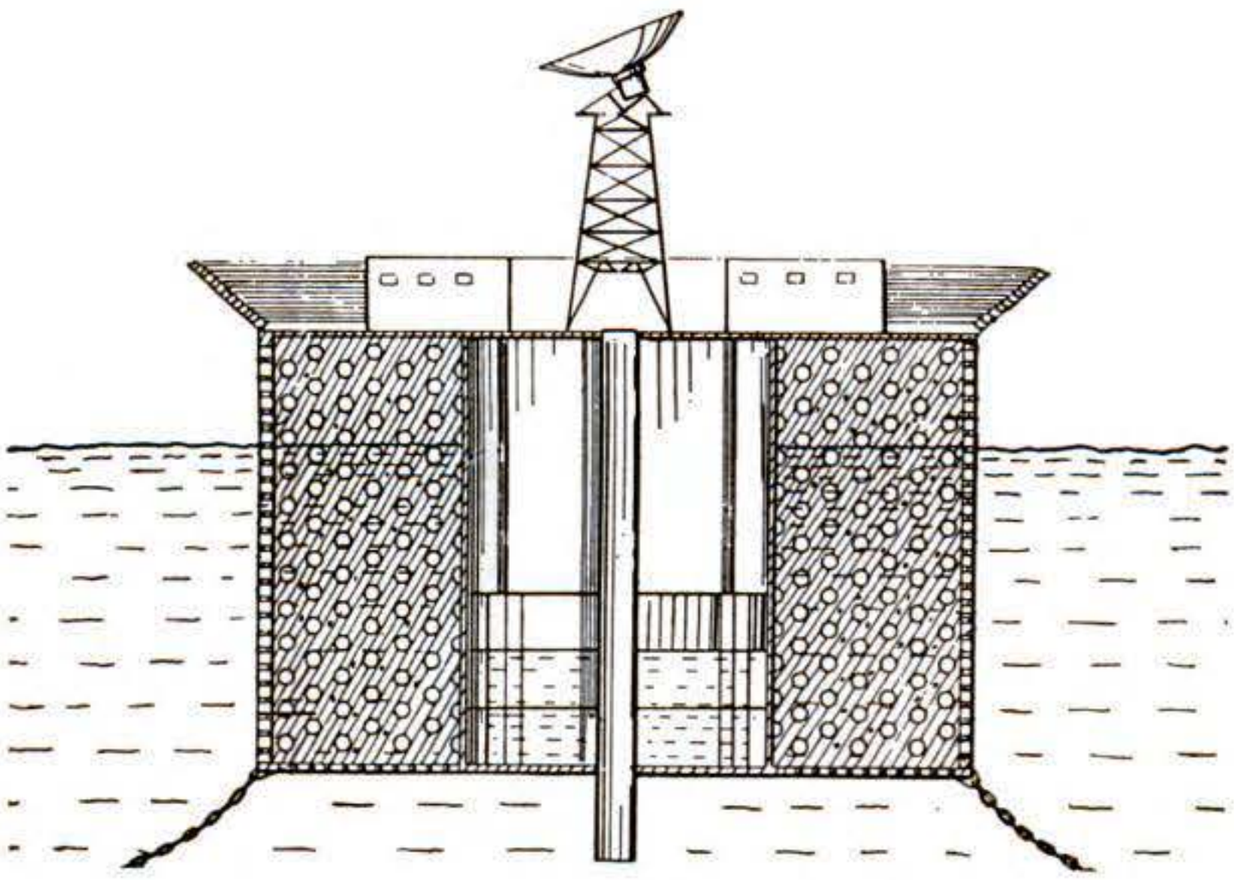
Gerard E. Jarlan, a hydraulic scientist of Canada's National Research Council, designed the wall, and it has been erected in the Gulf of St. Lawrence. It has an outer perforated wall and a solid inner wall. The design captures oncoming waves and forces the sea to smother itself, instead of smashing up a restraining wall. When a wave slams into the holed wall, some of its energy is reflected from the solid portions and more energy is dissipated as the water pours through the holes. As the water rises in the inner chamber, it begins pouring back out of the holes, into the trough of the next wave—destroying some of that wave's energy. The wall can be used for breakwaters, docks, deep-sea drilling platforms, floating weather stations, and satellite tracking stations.



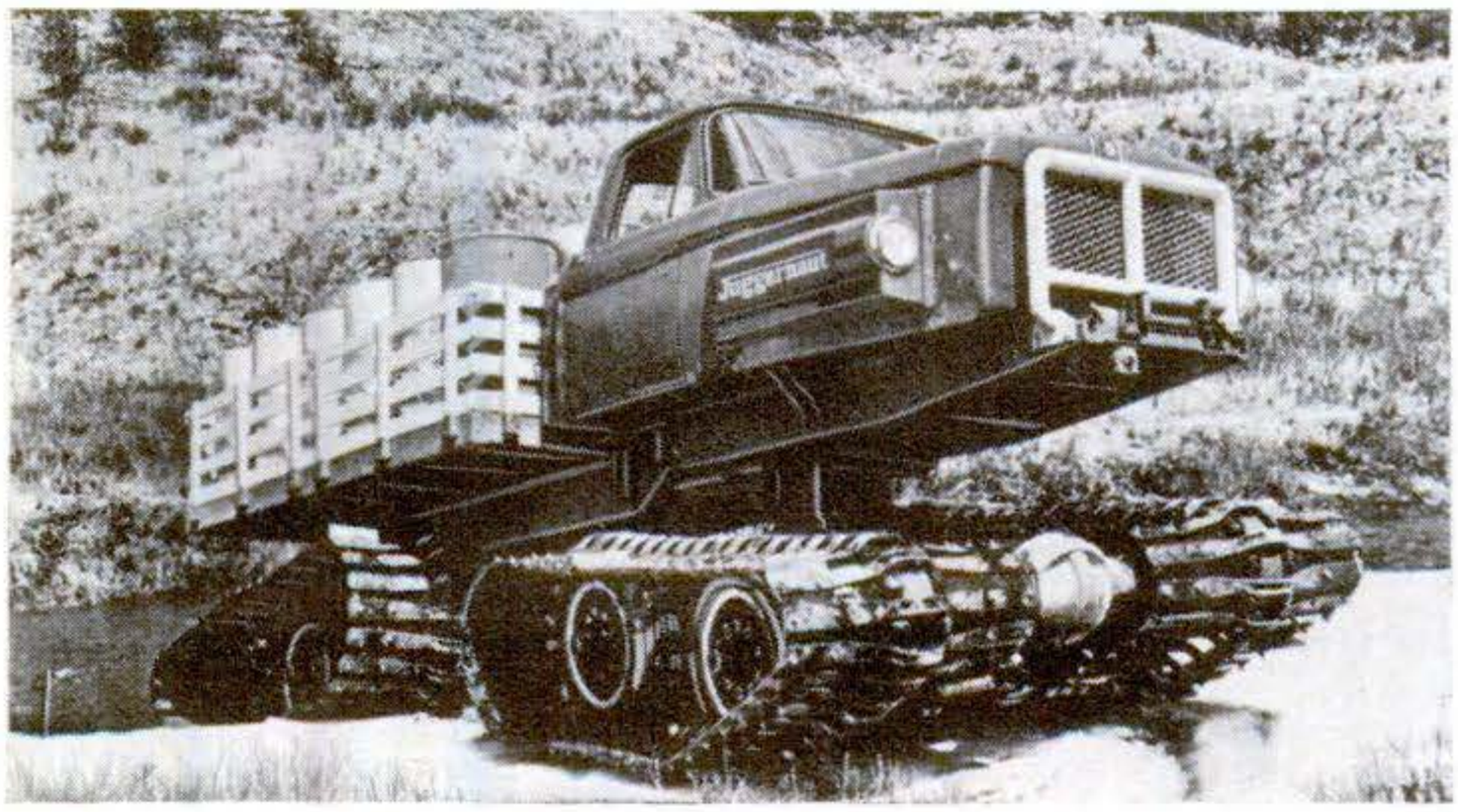
Perforated outer wall forms 1,000-foot-lo



A solid wall takes full force of a wave, which breaks over the top of the barricade.



Floating platform with holed outer walls, like this, could be used as satellite tracking station.



New off-road tracked vehicle really roughs it

The Juggernaut, an eight-ton tractor built by the Logan Division of Thiokol Chemical Corp., can slog through five feet of water or carry cargoes over mud, ice, or snow. The off-road vehicle is 26½ feet long and 116 inches wide. A 391-cu.-in. Ford V-8 powers it for a top speed of over 20 m.p.h. It can handle a forward grade of 60 percent and a 55-percent side grade.

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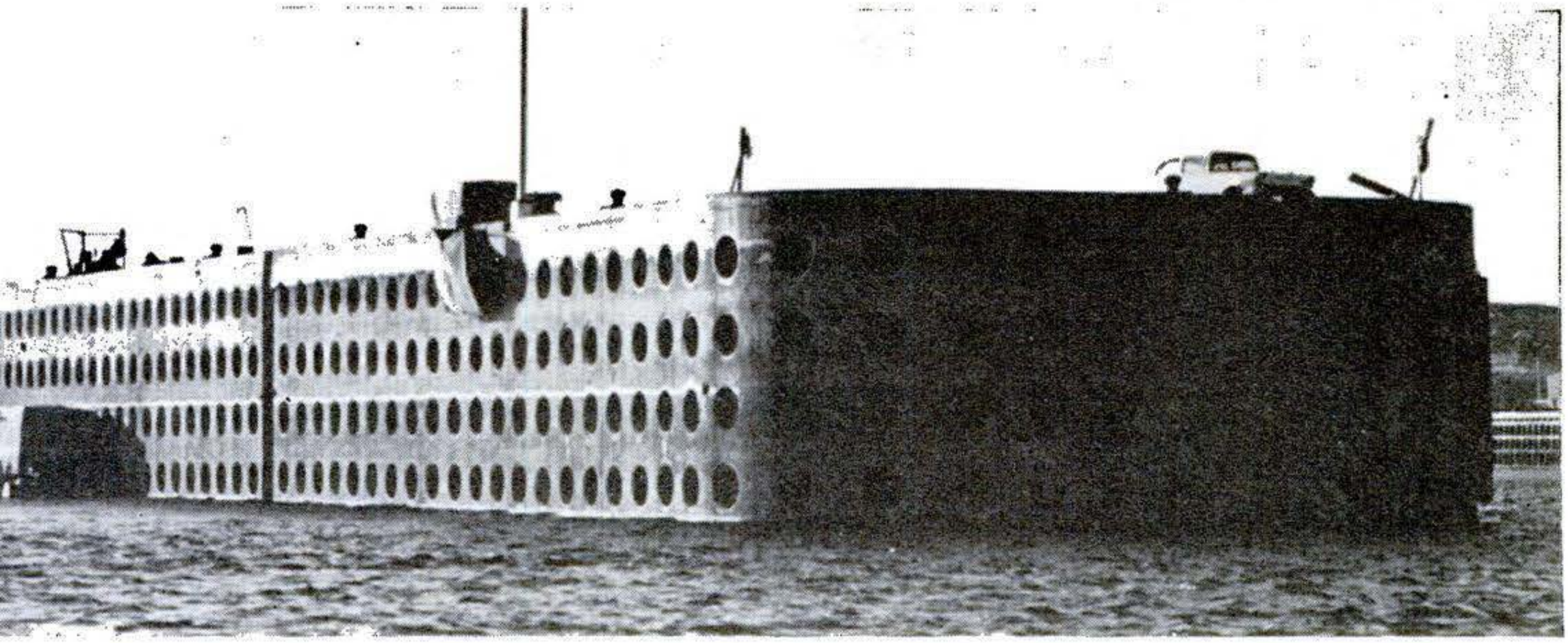
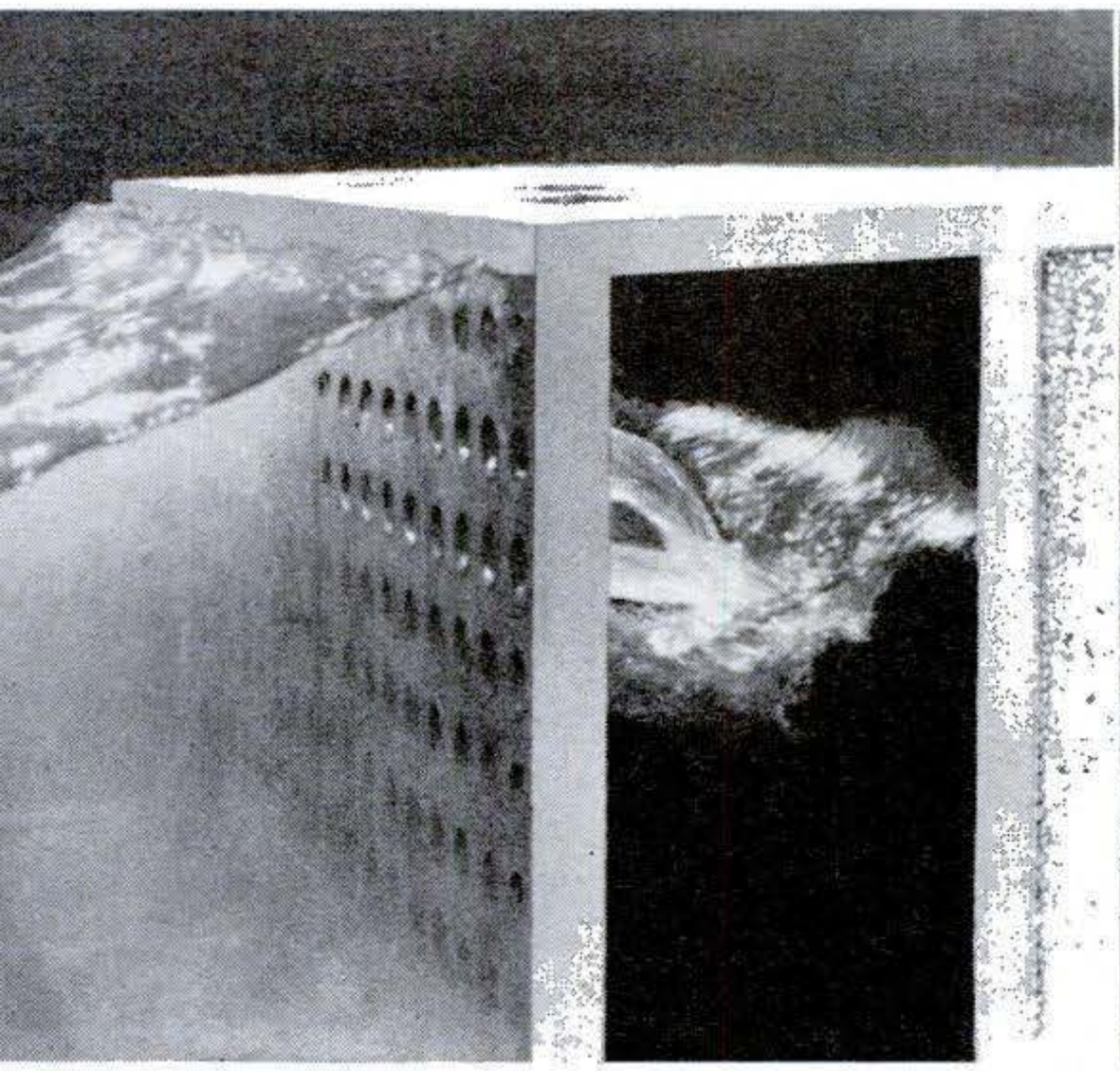
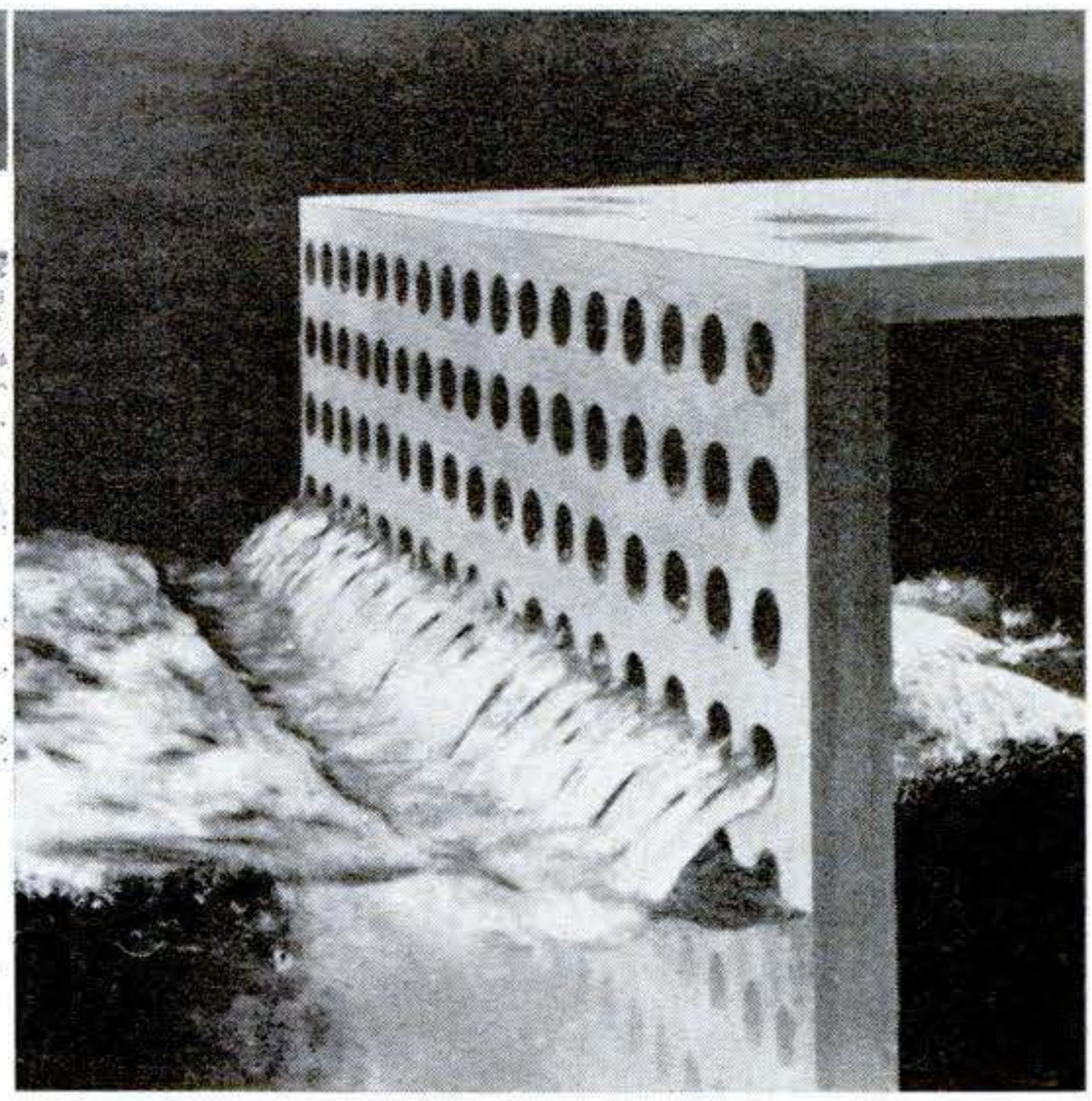


eakwater-wharf that makes the sea work against itself to take the "starch" out of the waves.



Perforated wall tames the same wave in experimental setup. Water just sloshes through holes.



Energy of new waves is dissipated when water from preceding wave empties into trough of next wave.

Parking lot is built over railroad tracks

Like most places, England is running out of parking space. As their answer to the problem, a Birmingham factory built a "lot" for employes over a railroad line. It rests on the banks of the cut, centrally supported by columns flanking the tracks. Two levels provide slots for 340 cars. Ramps to the top deck are electrically heated to prevent icing in the winter.

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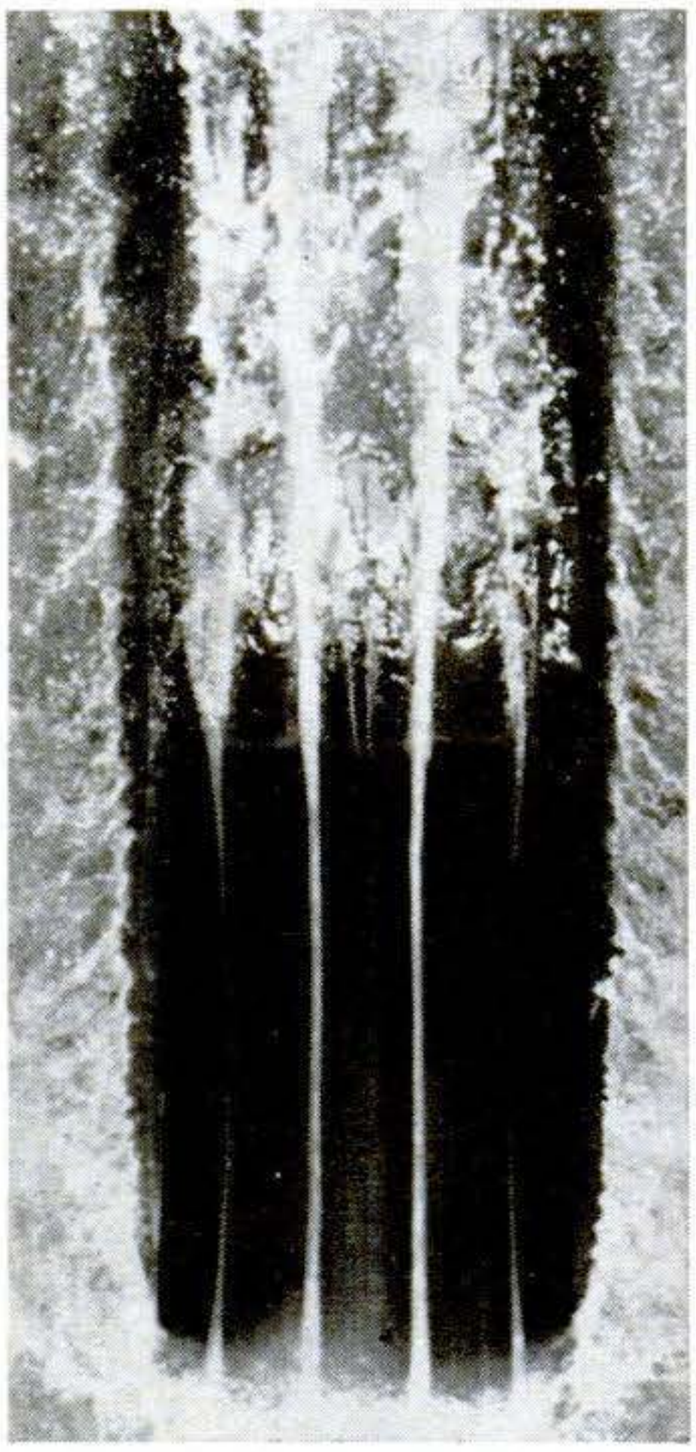
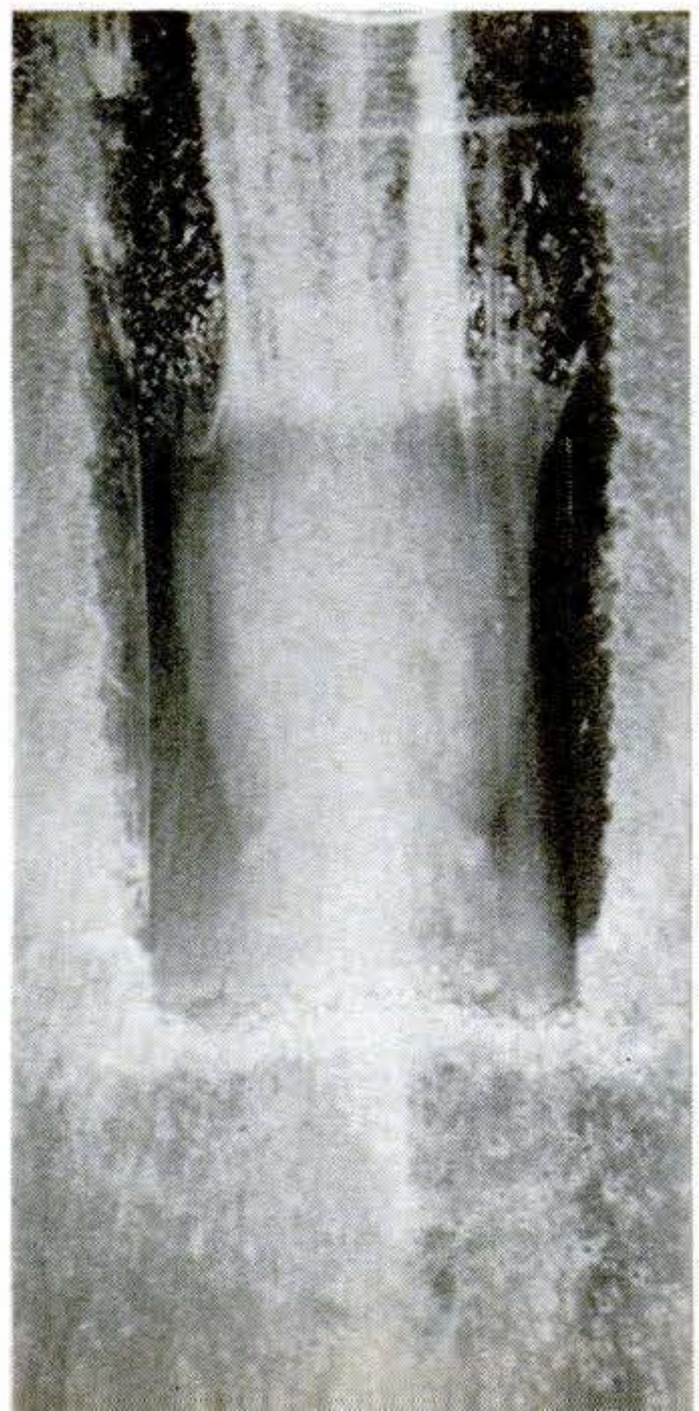
Stop skidding!

New Research Is Whipping



This tire still has road contact but will hydroplane in a moment.

This tire has lost all road contact—car is now out of control.



By **DEVON FRANCIS**

On a section of Southern California's Santa Ana Freeway, adjacent to Laguna Canyon Road, 28 accidents occurred on wet pavement in 1965. Early last year the highway department did something to the road. The wet-pavement problem has ended.

On a piece of Interstate 35 in downtown San Antonio, Tex., between the North Flores St. and Broadway overpasses, 120 wet-weather accidents occurred in 1961. Engineers did something to *that* stretch. It reduced the number of accidents.

On Interstate 20 east of Atlanta, Ga., the state highway department built up a record of bad accident areas on curves. Engineers last May did something on that stretch, too. While it's too early for them to draw solid conclusions, they are highly satisfied, so far, with the reduction in the accident rate.

At long last science is discovering the real reasons for wet-weather automobile crashes that have cost scores of thousands of lives in the last decade. The cures now being undertaken may save your life and the lives of family members in your car.

In March, 1964, POPULAR SCIENCE ran an article on skidding that told for the first time in a national publication of the phenomenon of automobile "hydroplaning"—the actual separation of tires from the pavement by a film of water under your tires.

From NASA: help for motorists. A lot has happened since. Under the research leadership of the National Aeronautics and Space Administration's Langley Research Center, Hampton, Va. engineers are developing means to whip your greatest driving hazard: wet-pavement skid.

There is something that you yourself can do to help, and a little later in this article I am going to give you a simple formula for avoiding that kind of a skid. If, in the process of telling you the story of this new research, I scare the pants off you, that's exactly my intention.

You *can* stop skidding.

Highway experts had recognized this weird thing, hydroplaning, as much as six years ago, but up to 1964 they didn't know:

- There are two kinds of hydroplaning.
- Tire treads can be designed that will minimize hydroplaning, but the motorist must cooperate at his wheel.
- The fatter the tire—like those new wide-oval jobs [PS, Dec.]—the more dangerous it is in wet weather, *but*

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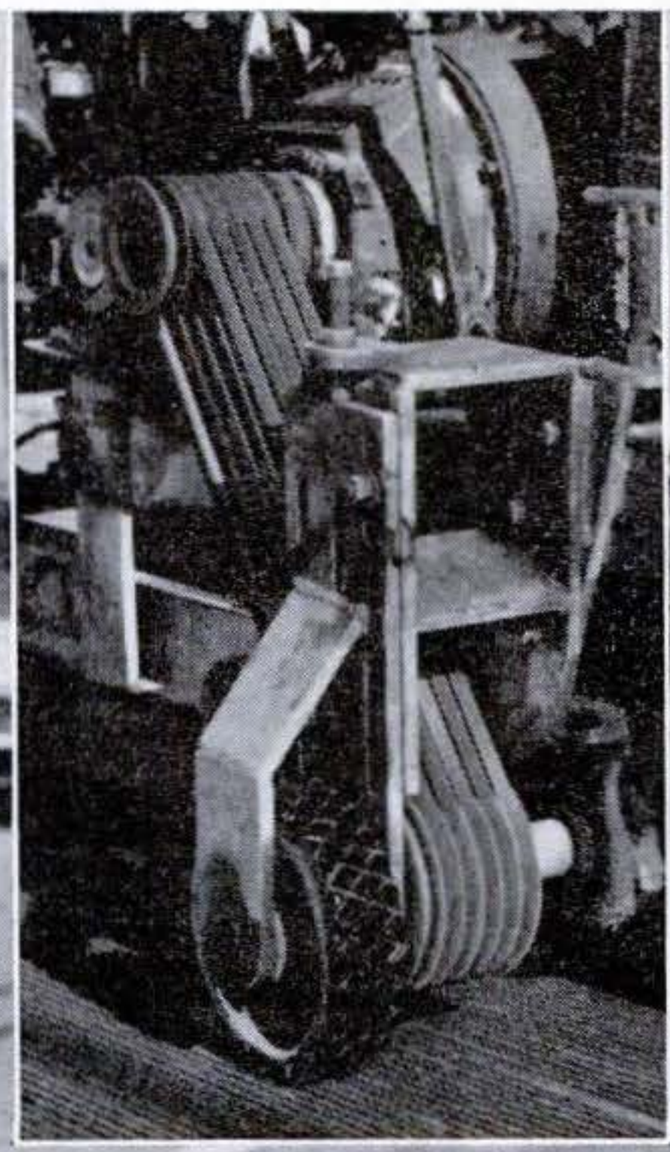
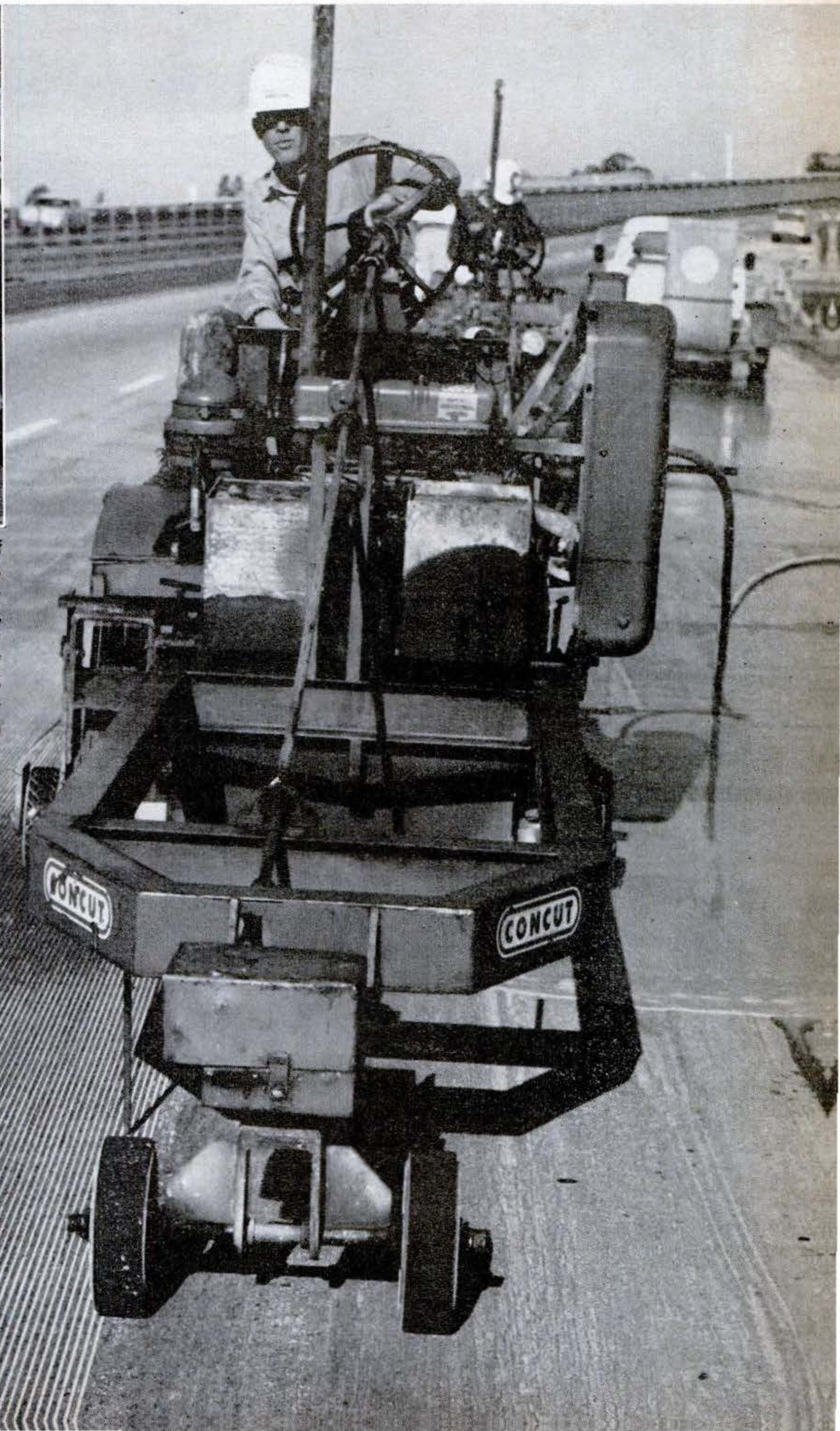
The causes of wet-pavement "hydroplaning" are now clear. Here's what you can do about it, and how road engineers are helping

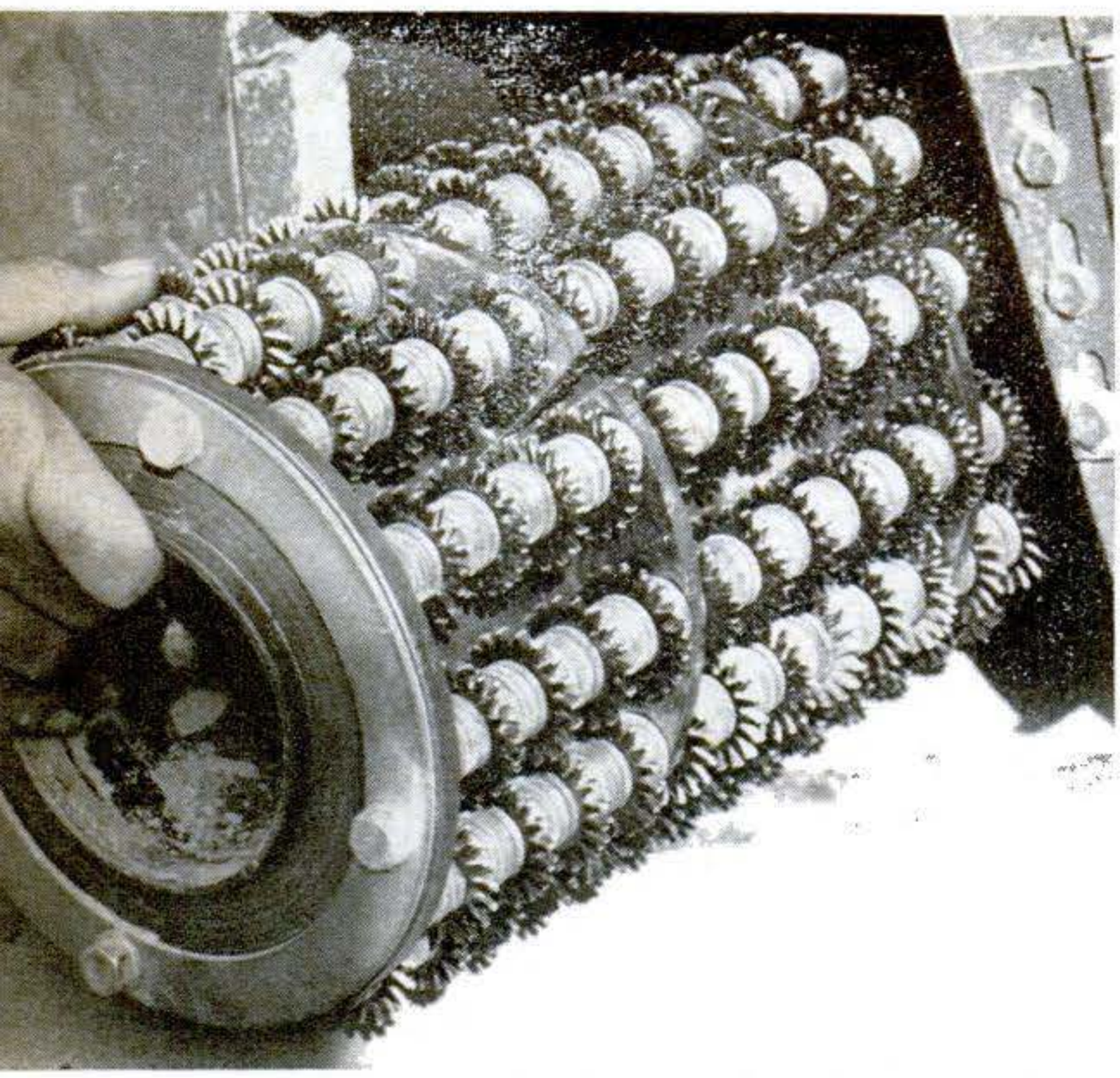
Your Greatest Driving Hazard





Close-up of business end of grooving machine (above) shows series of belts driving diamond-tipped cutting heads. At right, groover is in action on Southern California's heretofore deadly Santa Ana Freeway. Serrations in roadway have almost completely eliminated accidents on wet pavements here.

Outdoor laboratory grooving for NASA is being done here by G. H. Tennant Co., Minneapolis. Grooving is beneficial on dry as well as wet pavement—tire penetrates it to get additional car traction.



Hardened-steel cutters are used in lab operation to groove concrete. In more general use are cutters tipped with industrial diamonds. California reports little wear on grooves after three years.

only at higher speeds. They are safer at low speeds and safer than standard tires on dry pavements or roads.

- Pavement surface textures have a lot to do with preventing skids—but not for the reason that you may think.

Now let's see what science has uncovered about wet-pavement skids.

The commonest type of hydroplaning is called "dynamic hydroplaning." A "stagnation pressure" of water builds up ahead of a tire. As car speed goes up, the tire literally mounts this cushion of water. It hydroplanes like a water ski. The water chokes the open spaces in the tread. For all practical purposes, the tire is bald.

Like speeding on ice. If it's your tire, you have no more control of your car than if you were speeding along on ice. A gust of wind can throw you into an uncontrollable skid. Some authorities believe that dynamic hydroplaning accounts for the majority of single-car accidents in wet weather.

In water less than 12/32 of an inch deep —nothing at all unusual in a brisk downpour—a brand-new, grooved-tread tire will hydroplane at a car speed of 54 miles an hour. A car goes out of control at a given speed at standard inflation pressures when the water depth exceeds the tread depth. When new, standard Akron tires have a tread 11/32 of an inch deep.

The other kind of hydroplaning is known as "viscous hydroplaning." It occurs on mirror-smooth pavements, with badly worn tires. Langley experiments, as reported by Walter Horne, one of the NASA center's research engineers, and an associate, Upshur T. Joyner, before a Society of Automotive Engineers congress in Detroit, show that viscous hydroplaning can occur at speeds much lower than those required for dynamic hydroplaning, and on a film of water only 1/25 of an inch thick.

The water has a tough surface tension that even hundreds of pounds of pressure—from a smooth tire—can't break. This tension is the same thing that causes water to encapsulate itself in a dewdrop.

Viscous hydroplaning is perhaps more treacherous than dynamic hydroplaning be cause you are less aware of the danger.

Escape routes for water. There is an answer to both kinds of hydroplaning in tread design and tire shape and your—the motorist's—behavior. The best design is known as "open-treading" plus "siping." To

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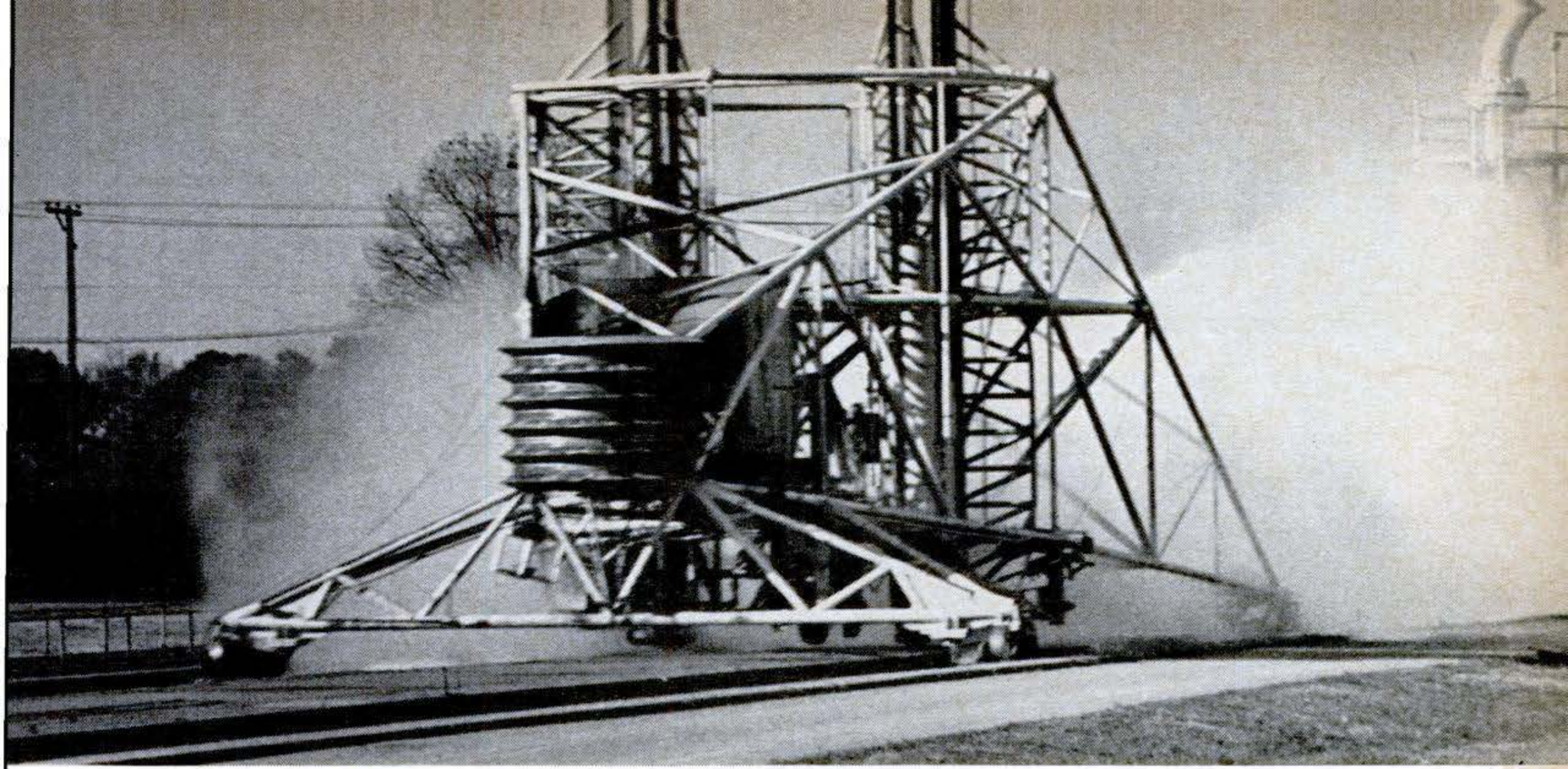

Machine weighing 100,000 pounds, propelled by water jet, is employed by NASA's Langley installation to test tire behavior on water and ice. A tire mounted within it can be run up to 120 m.p.h.

remain in contact with the pavement, a tread must provide avenues for water to escape. So-called "dimple" treads are useless.

When a tire flattens at the pavement part of its cycle, the squeezed water must have squirting room.

Siping is the thread-like squiggles in a tread. Even on a smooth pavement they provide hundreds of tiny local pressures in the tire footprint to break the surface tension of the water and put the rubber of your car on the road.

But no tread will give you traction if you ignore a few simple rules:

Stay below your estimated hydroplaning speed.

Keep your tires at the manufacturer's recommended pressures.

Don't drive badly worn tires.

Here's that formula I promised you: As a rule-of-thumb, your tires will start dynamic hydroplaning in the rain when you multiply the square root of your tire pressure by 10. A sample: You are carrying 25 pounds of pressure. The square root of that is five. Five 10s are 50. Fifty miles an hour is your danger point.

Car weight has nothing to do with your safety from skidding. That's because the heavier the car, the bigger the footprint. Car weight per square inch of pavement remains essentially the same.

How much inflation? Tire inflation pressures, however, play a part in dynamic hydroplaning. If a tire carrying 25 pounds

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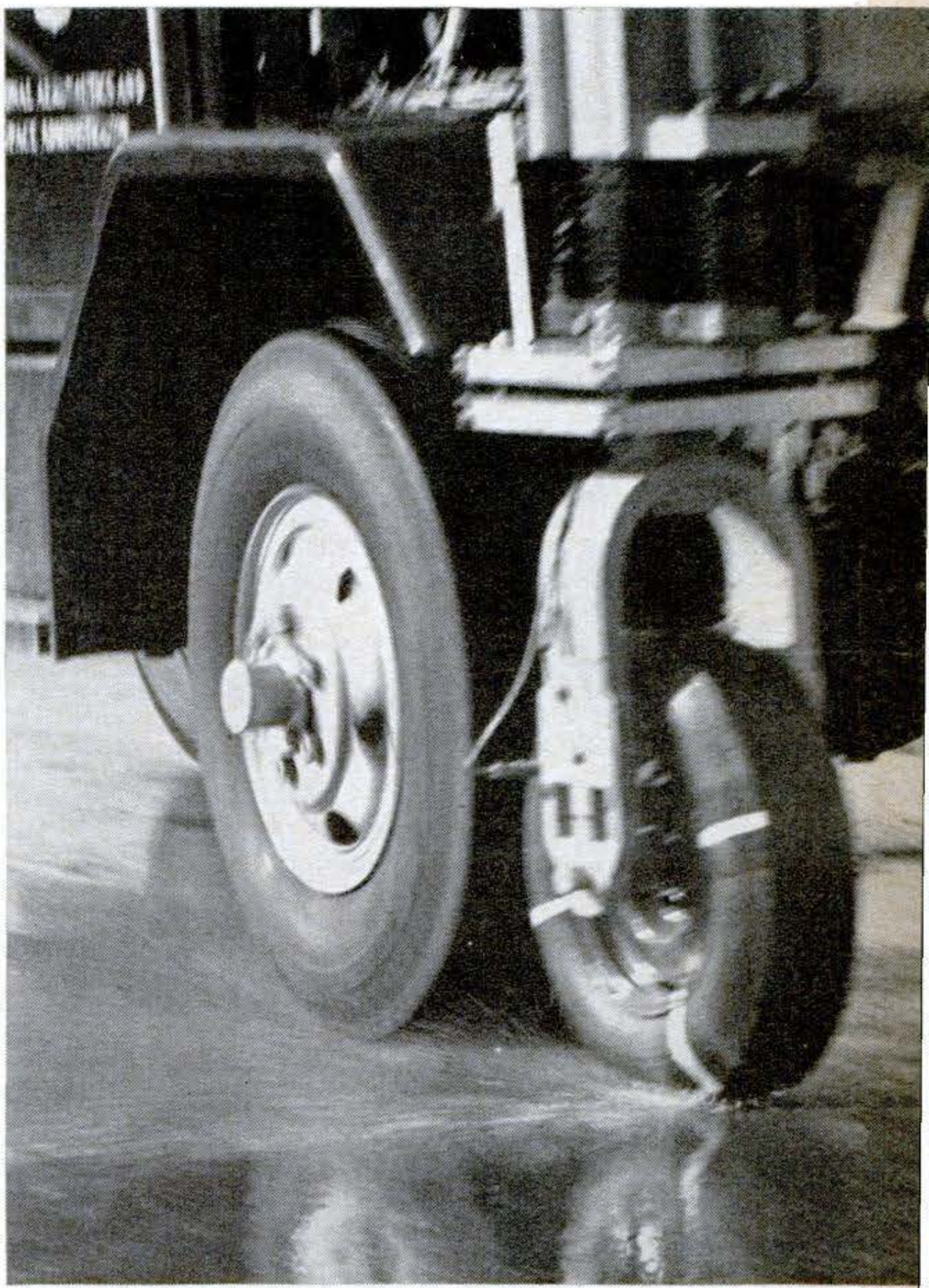

Truck fitted with machine to impose loads in excess of 1,500 pounds on auto tires, to measure drag and side-force friction coefficients, is another NASA test rig. Tests run up to 20 degrees of yaw.

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Most effective way to expel water trapped between a moving tire and wet pavement and thus delay hydroplaning is to mold circumferential grooves in the tread, as in left tire. "Siping" with thread-like cuts, as in right tire, in addition helps break water film. Driving a bald tire is inviting disaster.

will hydroplane at 50 m.p.h., raising the inflation to 40 pounds will delay hydroplaning to 62 m.p.h. That's because higher inflation puts less rubber on the pavement and increases the pressure per square inch of contact. And here another nutty factor in wet-pavement driving intrudes itself: The highly inflated tire is more dangerous at low speeds in a downpour because it supplies less traction, less rubber in contact.

Raising inflation pressures has practically no effect on viscous hydroplaning.

The new extra-fat tires can be dangerous at speed in rain, because they impose less pressure per square inch on the pavement.

The most electrifying development in wet-pavement driving safety in the last half-dozen years has been grooving the road surface itself. That's what the highway engineers, drawing on a store of NASA research, have been doing to those roads in Southern California, Texas, and Georgia, as well as to some in Ohio and Hawaii.

Channels in concrete. Grooving alters the road's surface texture. But it isn't because the surface is rougher that it's safer when wet. It's because the grooves, collaborating with tire treads, supply additional avenues for water to escape.

Grooving is used mostly on hills and curves. That's where motorists lose traction and control. That's where cars spin out, swap ends, slither into the next lane. Grooves are cut longitudinally—in the direction of travel—instead of transversely. It's working fine, but highway departments are still experimenting and engineers are not of one mind. They are grooving longitudinally now because the grooves tend to keep a skidding car skidding in a straight line—and, moreover, with available grooving equipment, it's cheaper.

California's grooving, done by Concut, Inc., of El Monte, the biggest company in the business, is ⅛ inch deep, ⅛ wide, and on ½-, ¾-, or one-inch centers.

Georgia's, done by the Christensen Diamond Products Co., of Salt Lake City, Utah, is 3/16 deep, 3/16 wide, and—experimentally—on ¾- or ½-inch centers with either vertical or beveled sides. Up to now, the beveled groove on ¾-inch centers seems to be the most stable in Georgia's work.

Grooving won't work on pure asphalt, and the long-range results are indifferent if, on concrete roads, the mix does not include a hard-rock content. That stretch in San Antonio wore smooth in a few months.

Now airlines and airport operators suddenly have joined highway departments in this country to launch attacks on wet-pavement skidding. Contracts are being let for experimental runway grooving—on a transverse pattern because when the water is squished out, the cross-ribbing gives more stopping traction—at such airports as National in Washington, D. C., Kennedy in New York, and Kansas City Municipal. England has long used grooved runways.

Students of the skid know that it will take more than tire design and pavement grooves to whip it. Badly needed is tread-depth legislation, penalizing motorists for driving unsafe tires. Only one state, New York, presently has such a statute, requiring a minimum tread of 1/16 inch.

In the end, what may be far more important is the federal Highway Safety Act of 1966. It not only strongly recommends highway grooving, but permits the newly created Department of Transportation to curtail federal highway funds if recipient states don't wake up in a hurry to the hazards of skidding. PS

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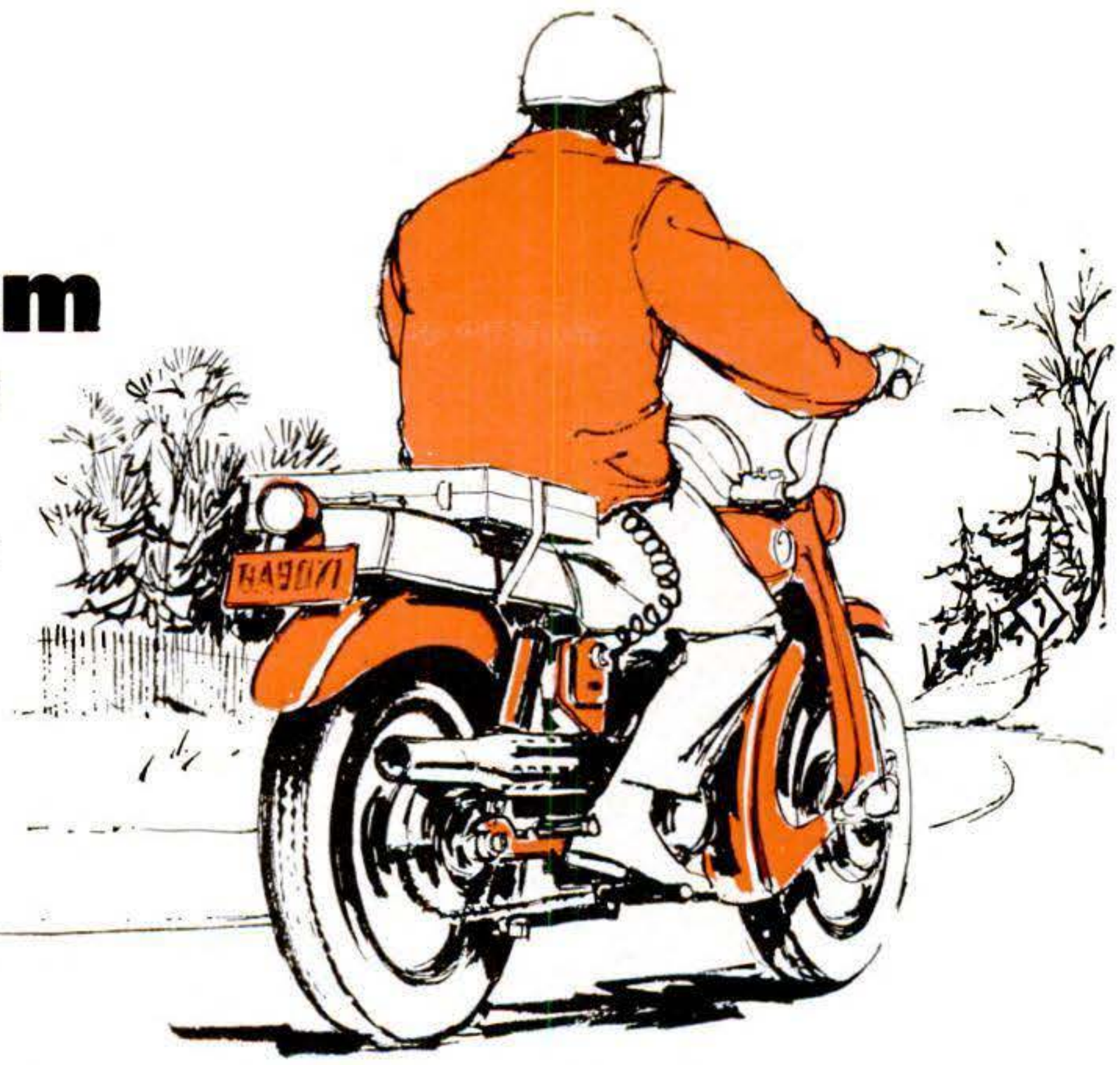
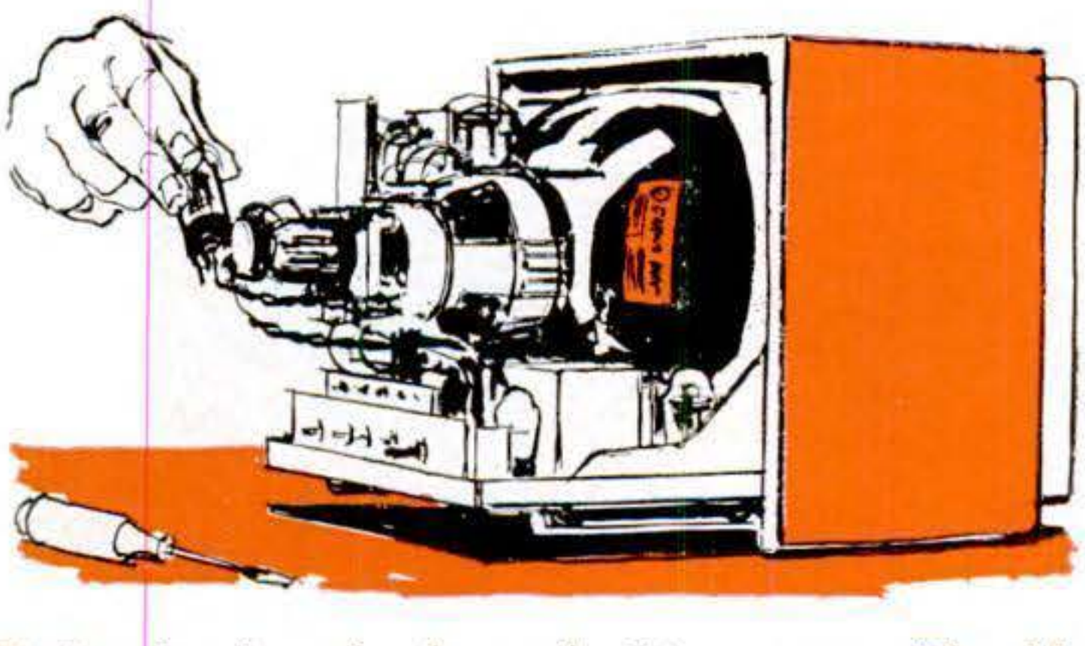
"I'd like to see them make . . ."

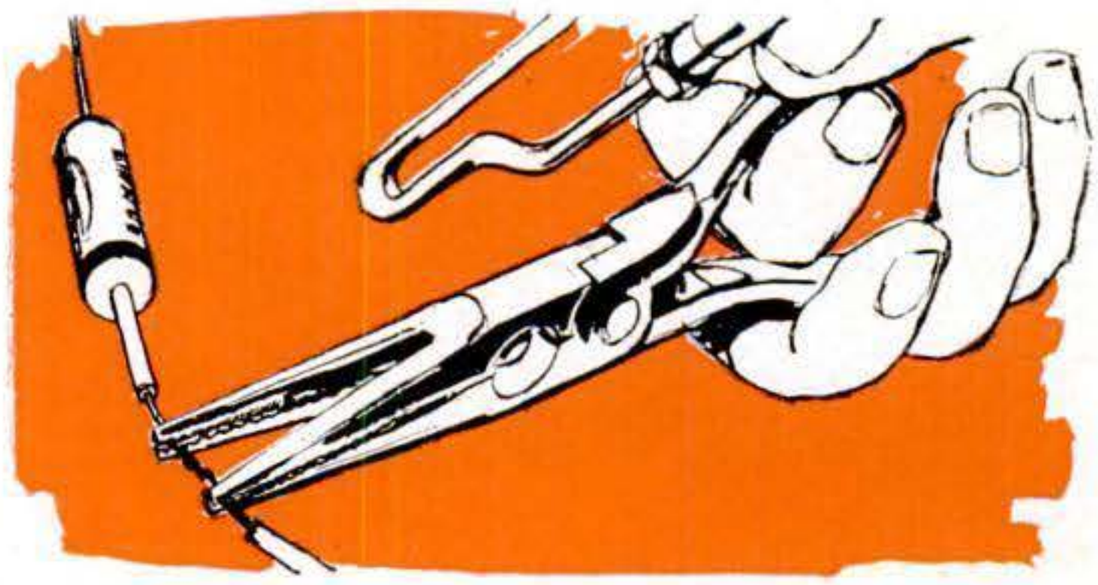
DRAWINGS BY DANA RASMUSSEN



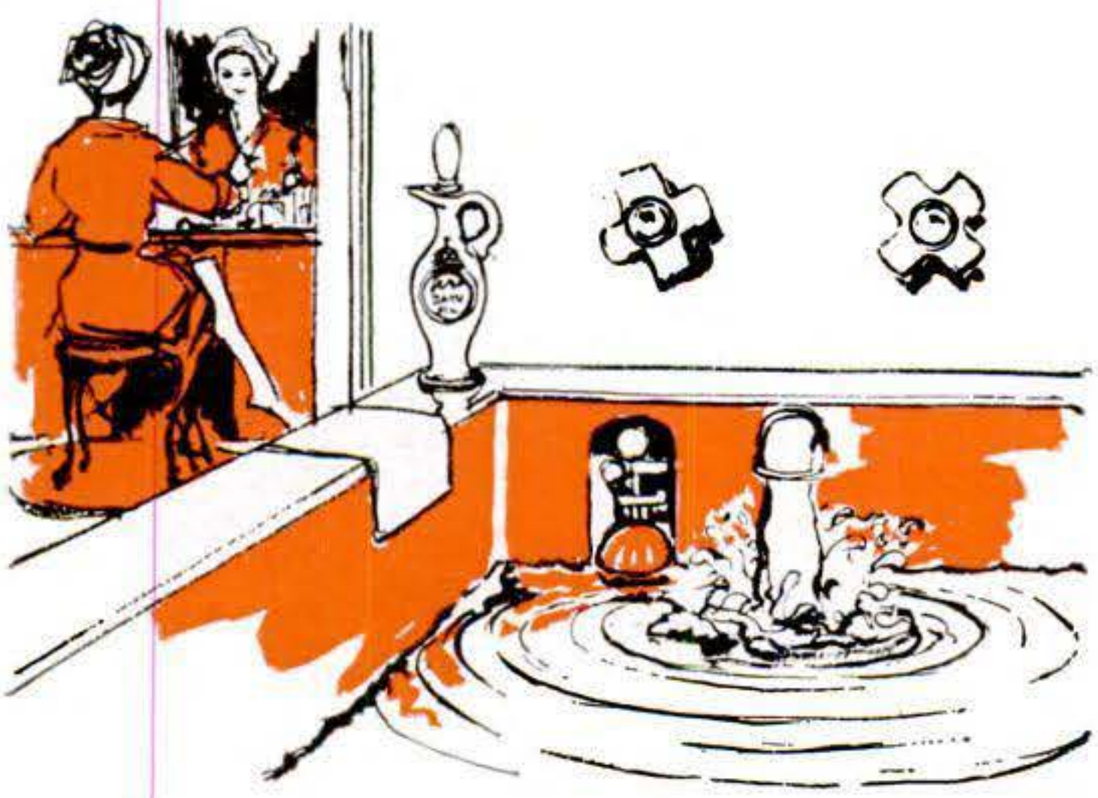
"Hot-rider" motorcycles equipped with an electric outlet. You'd plug in underwear wired like an electric blanket. An alternator would assure plenty of heat for the driver.—*Brian Helm, Ann Arbor, Mich.*



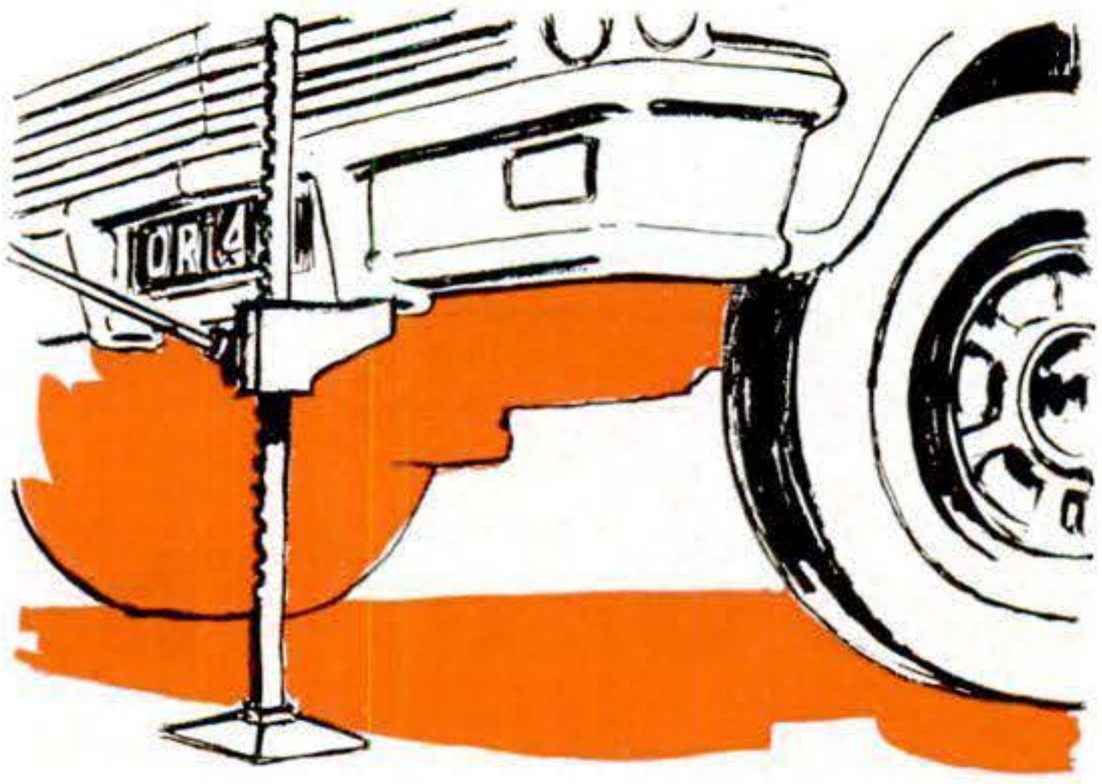
Roll-out chassis for television sets. They'd eliminate the need for a third hand to hold a flashlight when changing tubes or making minor adjustments.—*Richard Walck, Black River, N.Y.*



Needle-nose pliers with two sets of serrated, slotted jaws. The tool would make it a lot easier to hold two wires together for soldering.—*John R. Hand, Grenada Hills, Calif.*



Automatic-shutoff flow meters on bathtubs. Set 'em and you could leave the room while drawing a bath, or keep the kids from wasting water.—*Robert Ulloa Jr., Torrance, Calif.*



For safer jacking, heavy-duty bumper guards built to take a mating bumper jack. A socket on each guard at the jacking point could hold the jack securely.—*Harold Lunsman, St. Paul.*

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay $5 for each one published. Please use Government postcards only. Send to ILTS Editor, Popular Science, 355 Lexington Ave., NYC 10017. Write your name and address clearly. Contributions cannot be acknowledged or returned.

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Huge tentacled scar on the forested surface of the Feather River valley has been spreading since July, 1962, when work began on the great earth dam at its center. When it reaches completion this year, Oroville Dam will be more than a mile in length, ¾-mile thick at its base, and tower 770 feet high.

The Dam That Talks Back

World's highest earth dam will keep an eye on itself to report every stress and strain

By WESLEY S. GRISWOLD

The world's highest earth-filled dam, rising steadily near Oroville, Calif., toward its eventual summit of 770 feet, will let people know instantly if it ever feels the least bit shaky.

Such news wouldn't necessarily be alarming, for Oroville Dam has been engineered to withstand the strongest earth shock con-

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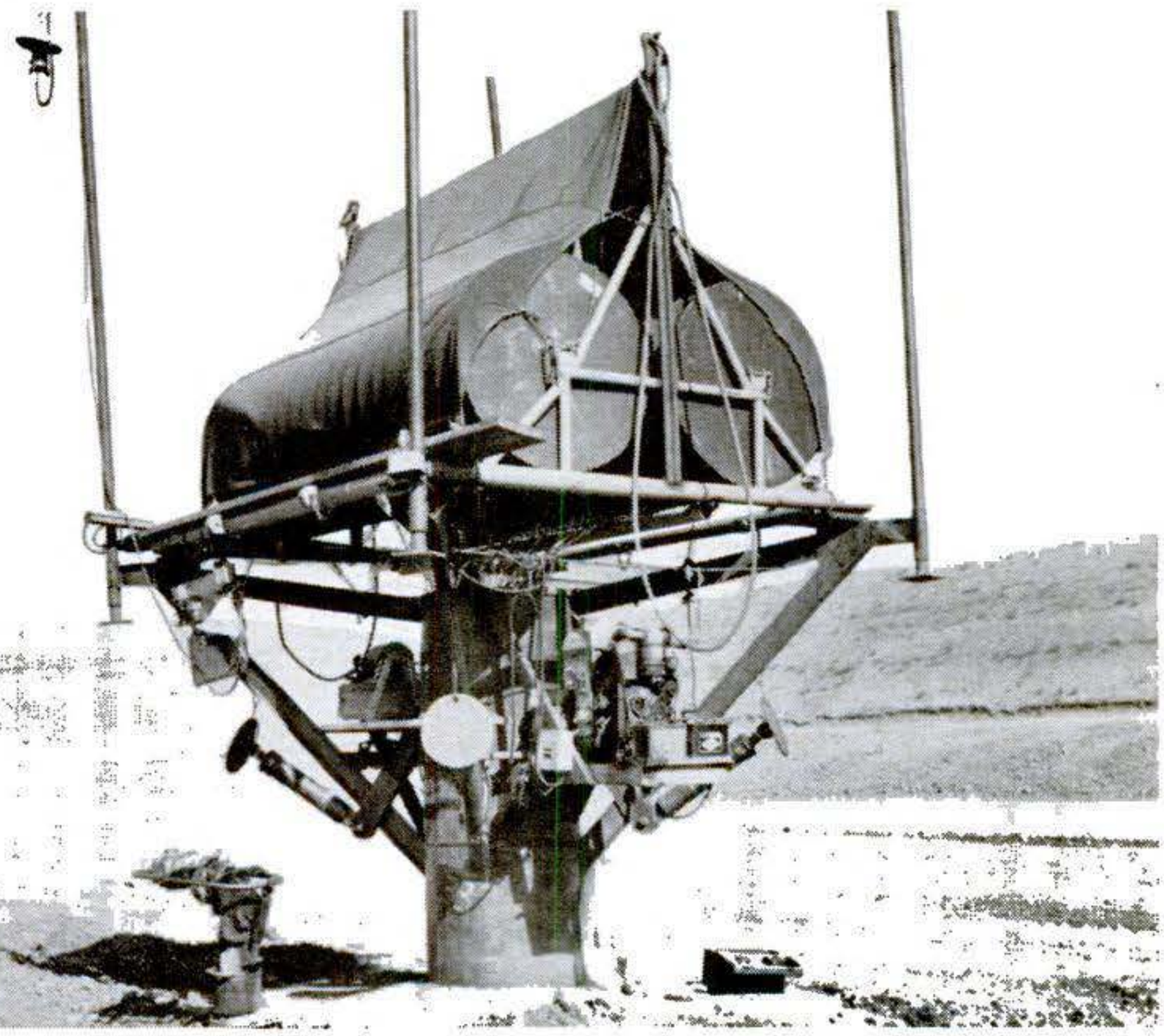
Gently does it, as workmen lower into the dam's pervious zone one of 15 dynamic-stress cells that will report every shock the dam senses.

Dynamic-stress cell is five inches thick, 30 across, and weighs 1,000 pounds. Nine lie along the 460-foot level; six will be bedded down at 580 feet.



Hundreds of instruments to measure settlement and water pressure at given points within the dam are embedded in the earth structure as it rises. Their connecting cables are carried upward on this odd-looking hydraulic riser.

ceivable. But it will be news of vital scientific interest, because it could make all future dams safer.

That's why Oroville Dam—which one day will hold back enough Feather River water to form a reservoir with 167 miles of shoreline and 24 square miles of surface—is the most heavily instrumented dam known. It's an outdoor laboratory for dam safety, in a state made especially aware of the need by its tragic Baldwin Hills Dam disaster in December, 1963 [PS, July '64].

Bonus from space. One instrument inside Oroville Dam is unique. It's called a dynamic-stress cell, and is based on technology deriving from the nation's space program. Fifteen of the novel cells are being embedded in the dam's massive heap of compacted soil and rock, like giant raisins in a super pudding. Some of them will lie under more than 300 feet of embankment. These big, round steel cells, a brand-new development in dam engi-

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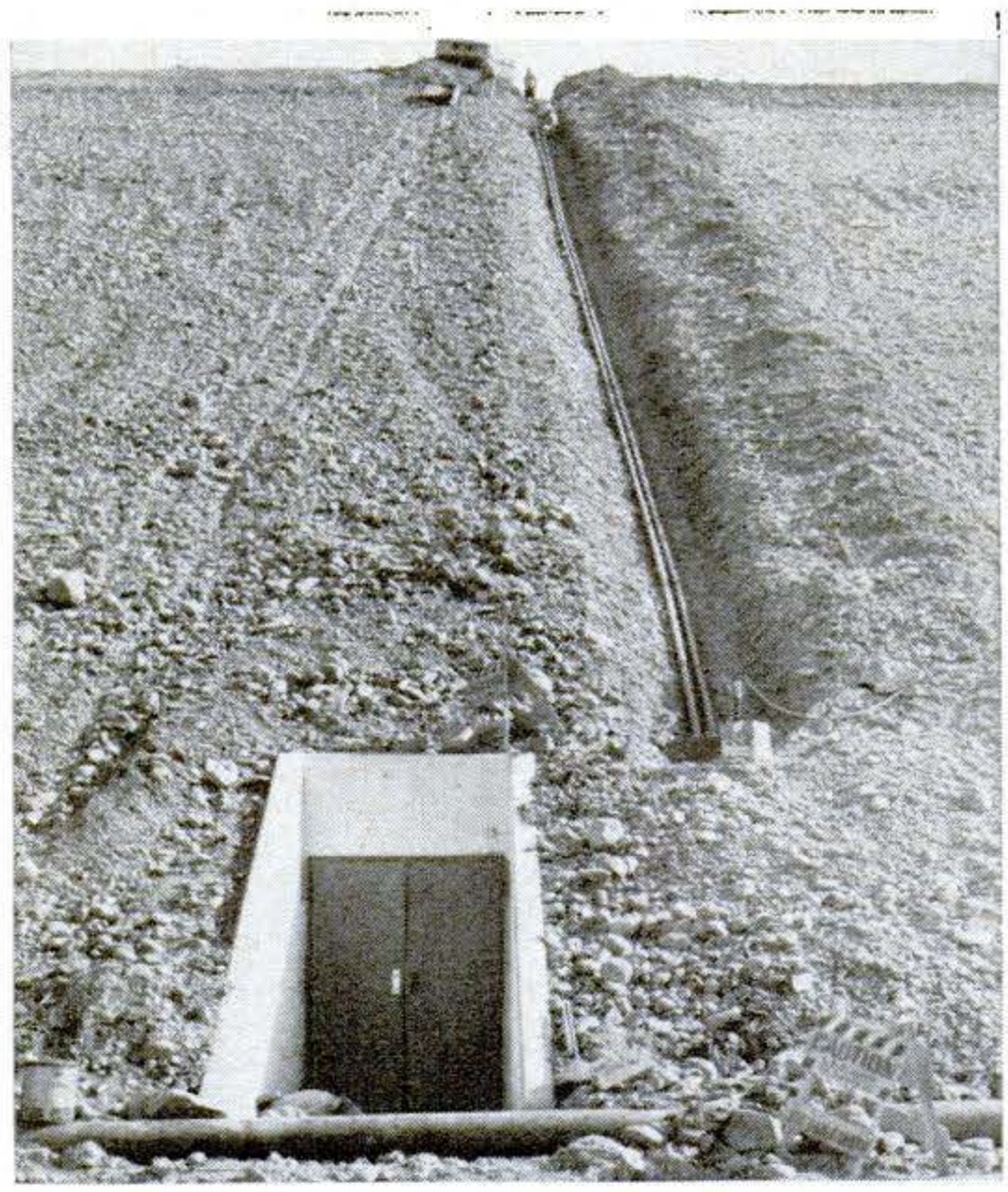
Shallow slit trenches to provide beds for the cables of the embedded instruments are dug in the Oroville Dam's heaped-up embankment—a 155-million-ton mountain of early gold-dredge tailings.



Oscilloscopes and oscillographs for registering and measuring signals from the dynamic-stress cells are located in this instrument house, tunneled into the embankment, near downstream toe of dam.

neering, report the impact of earth tremors automatically, and reveal static stresses any time at the push of a button.

The watchers. So sensitive are the cells that the first ones installed surprised everybody by recording the shock of a collision between work trains several miles away.

The dynamic-stress cells were created by Aerojet-General, best known as builders of huge rocket engines. Each cell is a 30-inch disk of stainless steel, providing a surface area of nearly five square feet to respond to soil stress. They are five inches thick and weigh 1,000 pounds apiece. A pressure plate is mounted across the inner face of each cell, but separated from it by a ⅛-inch gap. The gap contains a pressure-sensing fluid, developed for aircraft and missile hydraulic systems. Two independent, dissimilar sensors, sealed inside each cell, verify all pressure measurements by providing independent readings.

The cells are linked to a central recording station by thousands of feet of buried cable. Their messages are read in the green waves of oscilloscopes or in the automatic pen tracings of oscillographs. The latter are triggered by seismometers at a distance from the dam.

Oroville Dam is also studded with hundreds of other devices, conventional in type, for measuring stresses and strains, settlement, and water pressure at given points. It's a key structure in California's immense Feather River Project, which will eventually transport surplus water hundreds of miles from the state's northern regions to its semi-arid south. PS

Bidwell Bar Bridge was built to carry a highway around future Oroville Reservoir, which will have a 167-mile shoreline. Bridge is now 600 feet above water, but someday will clear it by only 47 feet.

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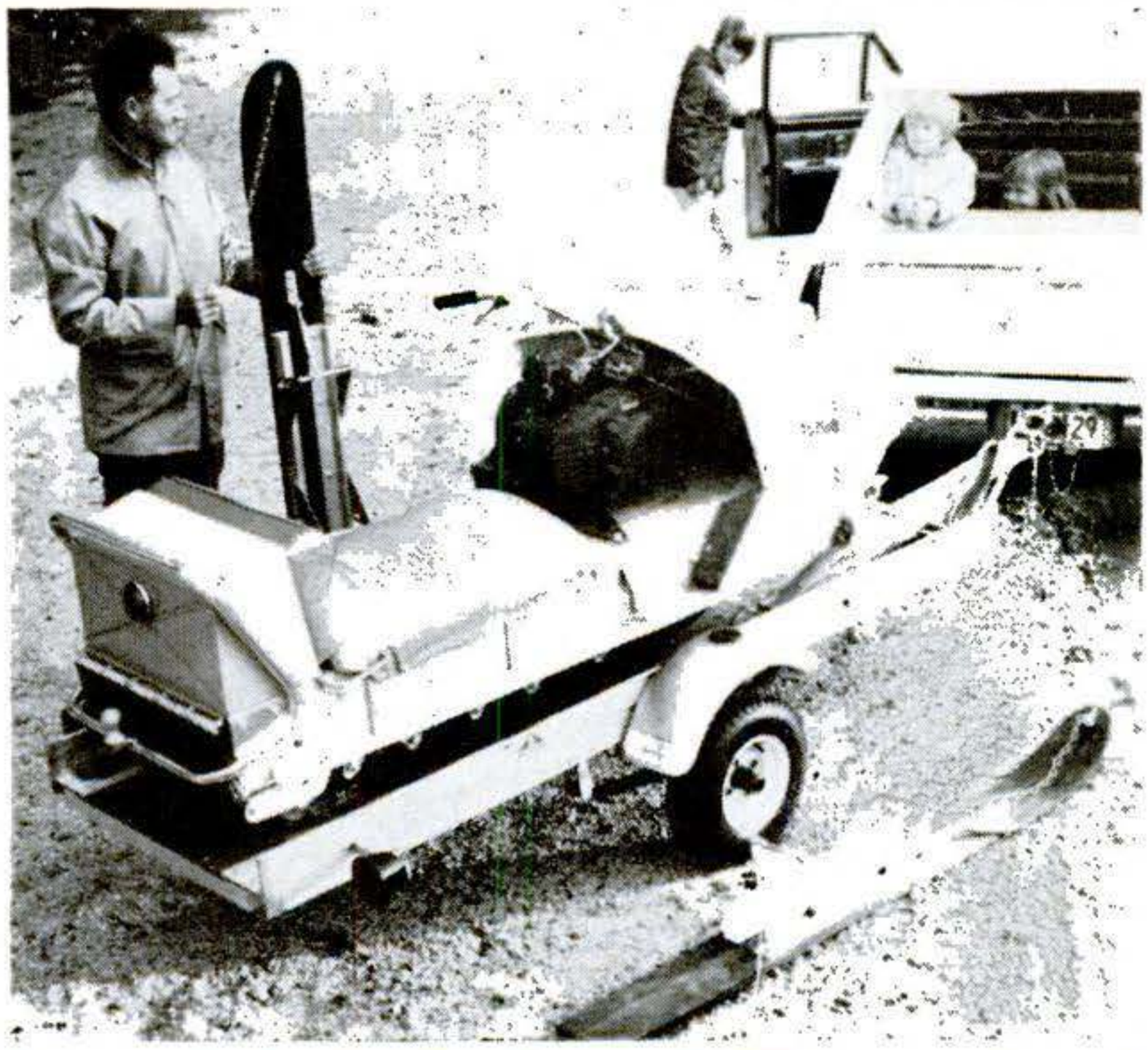
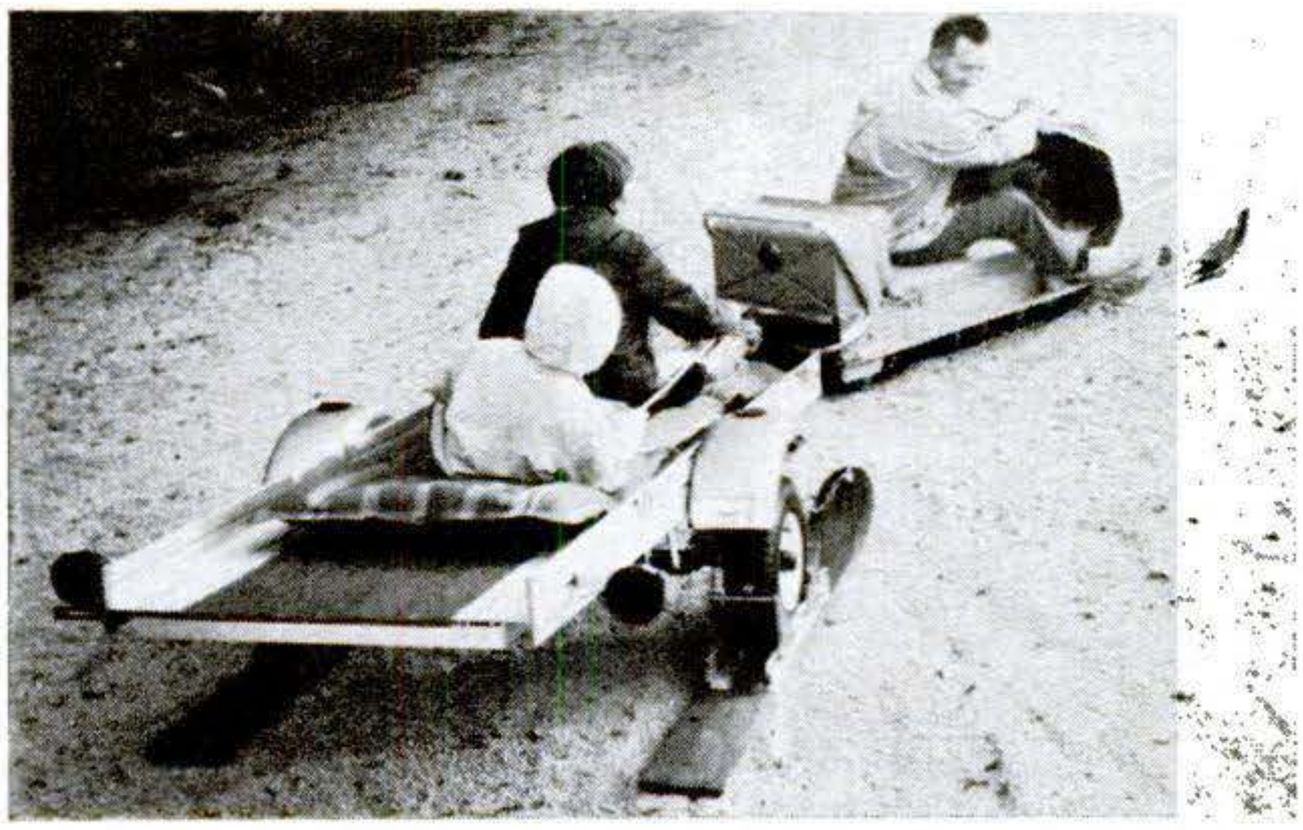
Snowmobile trailer doubles as passenger tow sled

You can drive your snowmobile to wherever the snow is on this lightweight trailer, then in minutes, convert the trailer into a capacious passenger sled. The sled will carry up to five persons, or can be used for hauling hunting, fishing, or other sporting gear too bulky for snowmobiles. The Sno-Tow shown, with 33"-by-8' bed, has a load capacity of 800 pounds, but weighs only 150 pounds itself. It's made by Trailex, Inc., 600 West Main St., Canfield, Ohio. Price of the snow vehicle is $175.



Optional skis for Sno-Tow trailer cost $50 per pair. You roll the trailer onto skis, lock the wheels in hold-downs and . . .



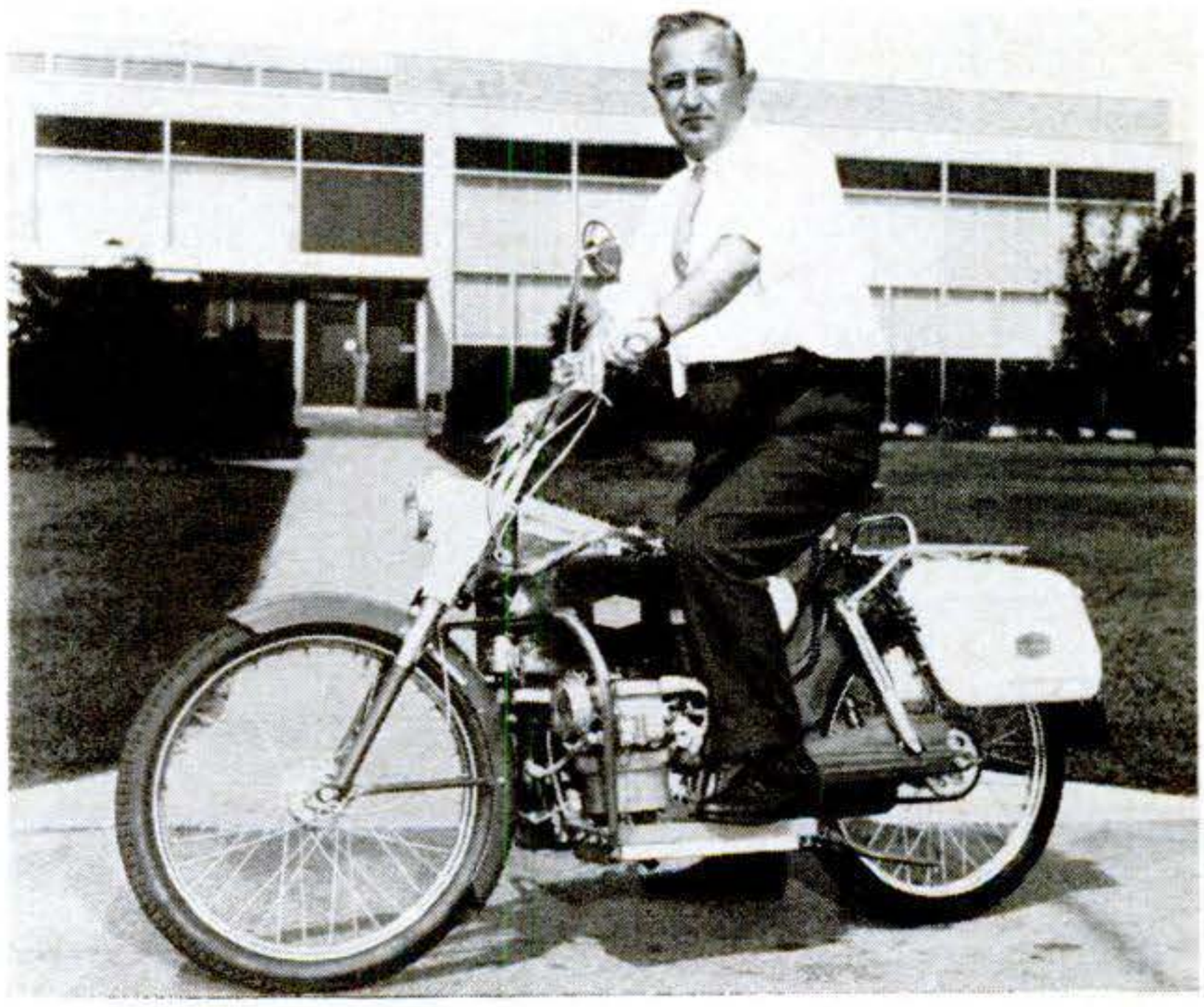
. . . it turns into a tow-sled for hauling passengers or freight.

Nylon line stops planes

This old carrier trick has been adapted for use by STOL (short take off and landing) planes for jungle-warfare strips. Planes like this M-21 are launched by catapult and use a nylon tape made by Goodyear to stop on short runways when landing. The system allows Marines in Vietnam to set up a combat-zone airfield for operational use in about 72 hours.

Fuel-cell motorbike runs 200 miles on gallon of "gas"

Dr. Karl Kordesch at right rides a fuel-cell motorbike built under his direction by Union Carbide. The vehicle runs almost silently and emits no exhaust. Instead of a regular bike engine, it is powered with a hydrazine and air fuel-cell system, which makes only a slight hum. The bike has a top speed of 25 m.p.h. and gets 200 miles to the gallon of hydrazine (mixed with air).



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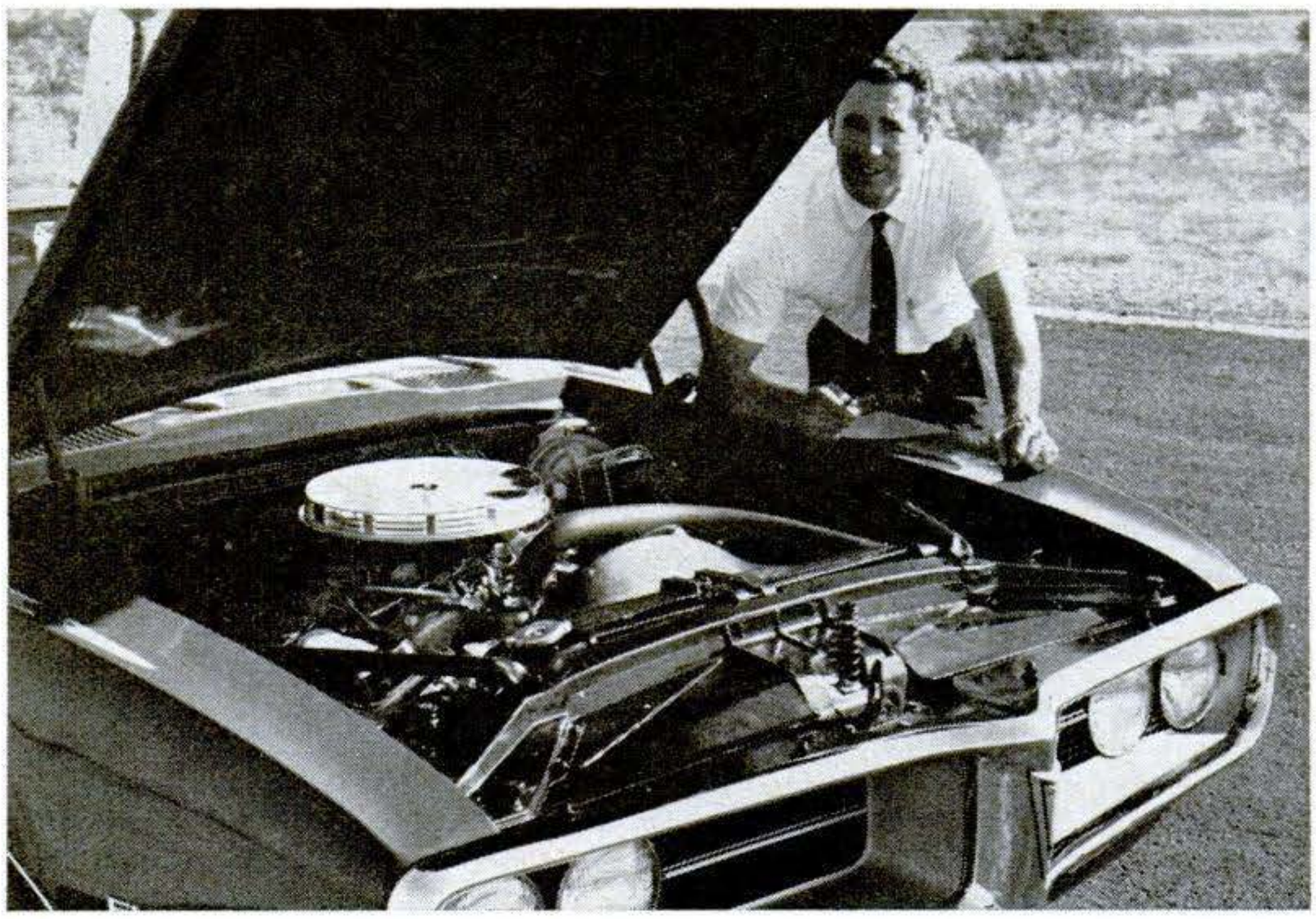
PONTIAC FIREBIRD: The GTO



The 325 horsepower of Pontiac's 400-cubic-inch V-8 proved adequate but did not quite come up to expectations. The triple-carburetor GTO version with 360 horses is not available in the Firebird—at least not officially.

Camaro-based, it's a higher-class car with surprising refinements in power train and suspension systems

By MARIO ANDRETTI

USAC National Champion, 1965 and 1966

PHOTOS BY JIM DUNNE/*PS Detroit Editor*

"Hey, Mario, Pontiac's got two Firebirds for you to test on GM's Arizona Proving Grounds near Phoenix. We can meet there day after tomorrow if you're free."

The friendly voice was Jim Dunne's, and I was happy to go. Phoenix is almost a home away from home to me. I race there several times a year and it's where Clint Brawner prepares my race car.

Of course I had heard for months that Pontiac was coming out with a new sporty car, but I didn't know exactly what the Firebird would be.

The first thing I saw was the front. It gives the car a definite Pontiac look, even if it shares the basic body and running gear with the Camaro. To my surprise, I was soon to find out that the Firebird is as different from Chevy's little roadster as the Grand Prix is from an Impala.

There was a big difference between the two Firebirds I drove, too. One was a convertible with a 325-hp. V-8, automatic transmission, and wide-tread tires. The other was a coupe with an overhead-cam six and four-on-the-floor.

The suspension. Apart from the Tempest drive train, Firebird has a few suspension refinements that are lacking on the Camaro.

The most important are two trailing arms alongside the rear springs. They keep the axle aligned at all times. In practice, this means that they keep the wheels firmly on the ground during hard acceleration and heavy braking.

Let me explain. A rear axle has two kinds of torque reaction. When you start off, the axle housing tries to turn in the opposite direction to the ring gear's rotation. This means that the nosepiece tends to lift. When this happens, the springs

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ets a little brother

Unmistakably Pontiac, with its split grille and dual air scoops on the hood, the Firebird's front is simple and gracious. But did the stylists forget about bumpers?

"wind up," and the axle runs out of line. The tail begins to pull to one side, and you must make steering corrections. The second reaction is for the axle to turn in the direction opposite to the pinion's rotation. This means that the right rear wheel tends to lift while the left is pressed down. The result is axle tramp and wheelspin.

On braking, the reactions are the other way around and less violent.

I have to say that the Firebird's rear suspension performed beautifully. On my acceleration runs I got a little wheelspin in both rear tires, and there was no side pull. On hard braking, the tail felt smooth and secure, free of unwanted motion. But on the V-8 model, Pontiac has also changed the standard ride into a nicely tamed, firm, sports-car ride, a noticeable improvement over the standard suspension. For one thing, you can go through long curves at high speeds without any porpoising—none of that front-end bobbing up and down. On tight curves you can feel the back end be-

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Firebird behaved better than Camaro on acceleration and braking, as well as on fast turns.

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"Dual look" of the front end is repeated on the rear body panel. Tail lights are split both vertically and horizontally. In contrast to the nose, the back end has a real bumper. The trunk is short, as on all other Mustang-inspired cars, but look what Pontiac did to increase trunk space (facing page).

gin to break away, but it's something you can control. Again, you notice a nice, firm feel to the car. It goes right where you steer it.

I gave the car some severe work on 90-degree turns like those you find in city driving. It reacts just the way you expect. You can predict just what it's going to do. One thing I noticed in particular: There's no whip-back or fishtailing on this car such as you get on the Camaro. I mean, when you take a curve and straighten out, the back end comes back where it should be and stays put. It doesn't swing over too far like a pendulum, then go back the other way again.

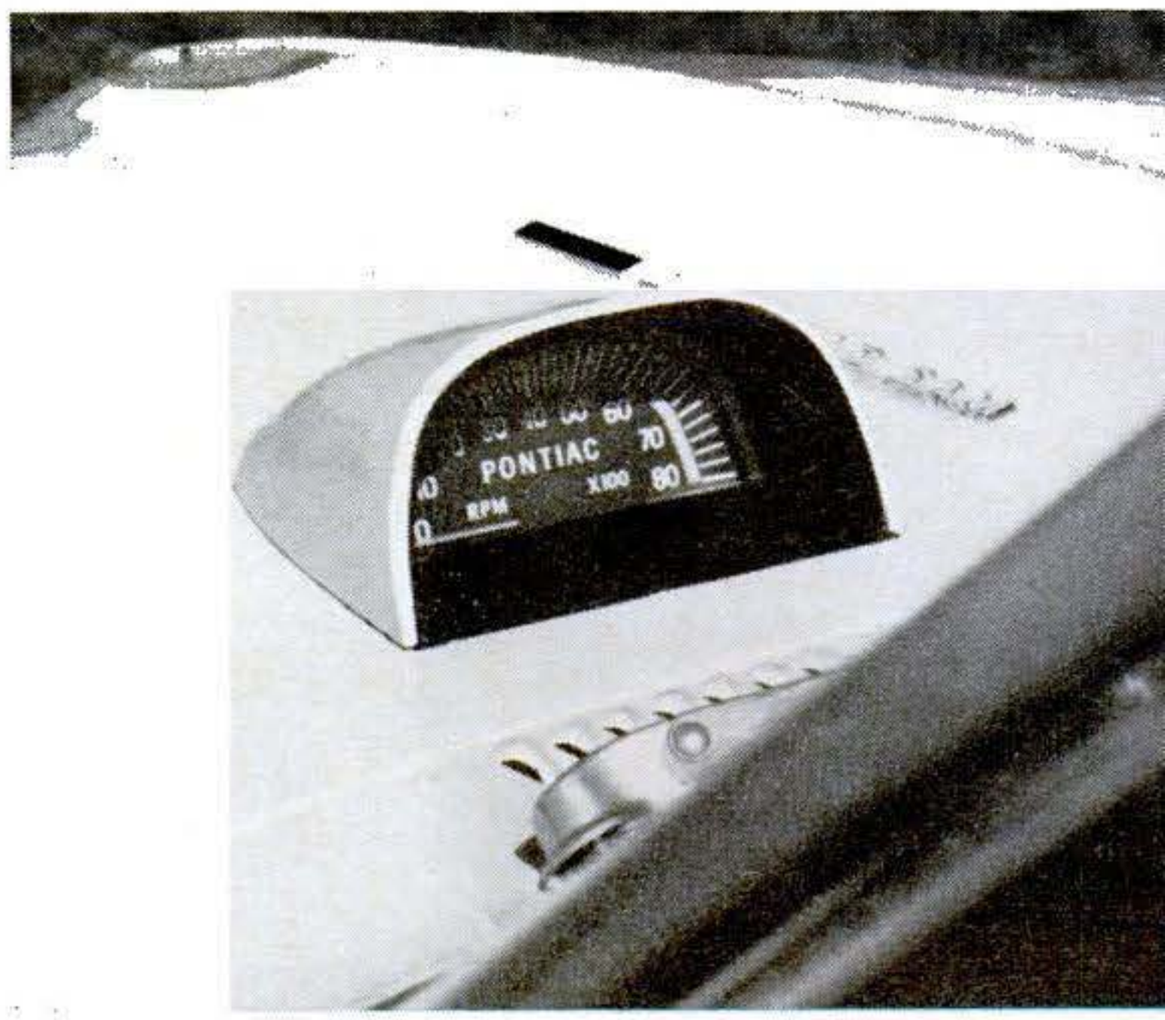
With the six-cylinder engine, the handling precision was not the same. The coupe I drove suffered from porpoising at normal speeds on fairly good surfaces, and it tended to get sloppy on the turns. The stiffer springs used with the big engine are essential on this car.

Braking. How does the car stop with the power disk brakes? Just fine. A trifle touchy, but they do the job. I also drove a disk-braked Firebird without power assist, and I definitely do not recommend that. It takes too much effort; you have to press too hard on the pedal.

The first test car was pretty quiet for a convertible, even at 75 m.p.h. There was little body shake and the hood was firm; it didn't zig back and forth like some. Overall, you get the feel of a stable, solid car, something you don't often find in a soft top. While the car runs solid and true at high speeds, body shake shows up at low speeds, from about 15 to 25 m.p.h. This happens only on the convertible.

That brings up another point. Firebird convertibles have "tuning cylinders" mounted at the extreme four corners to cancel out the natural shake you get in a body of this type. They look like fruit-juice cans from the outside. Two are located in the trunk; the other two are under the front fenders. Inside the cans—you can't open them—are metal weights of about seven pounds each, suspended between two coil springs. The cans are also filled with oil. When the car is moving, the weights vibrate back and forth to counter low-frequency body shake. It's the same thing Ford has used on soft-top Lincolns and T-birds. It looks to me as if they're all making up for some mistakes in design.

Power. Now a word about horsepower. Pontiac rates this V-8 at 325 hp., but it performs about even with the 295-hp. Camaro I tested earlier [PS, Oct. '66]. Its performance falls short of the Barracuda 383 and the Mustang 390. Not quite as fast.



Firebird tachometer is in capsule on top of hood right in front of driver. It's easy to read, but perhaps more theft-vulnerable than inside tachs.

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It's smooth, but doesn't have the torque range you would expect. At 80 m.p.h., for instance, you don't get the surge that Barracuda has. From 90 to 120 m.p.h. the engine gathers speed grudgingly, as if it had gone flat. Barracuda's 383-cu.-in. engine showed real kick at these speeds.

As for low-speed torque, my times for 0-60 acceleration averaged 7.6 seconds. The best I could do was 7.4 seconds, and this came with the automatic transmission in drive all the way. Quarter-mile runs were made in the same manner. My best time: 16.2 seconds and 96 m.p.h.

The 215-hp. overhead-cam six is a good performer but can't be called a powerhouse. At 90 m.p.h. you can tell this engine is really turning to keep up the power. It's a good bet for the economy-minded buyer.

I like the four-speed transmission, too. It was a little tight, but it's very positive when it goes in gear. There's no play at all. Another thing: The stick has a nice short throw and still gives you good leverage. It's easy to reach, and you don't have to lean out of your seat to shift.

Like that tach. Before I get to the interior of the car, I want to talk about that hood-mounted tach Pontiac offers. I like it. It's something new to me. It lets you keep your eyes on the road even when you look at it. Actually, I take only an occasional glance at a tach—to check r.p.m. at certain shift points—so I don't take my eyes off the road very often. But in this position, tach reading is made easy. And it doesn't obstruct your forward vision. I definitely will suggest putting one of these on the cars I race.

The passenger compartment is much like the Camaro's, with controls well located, easy to reach. I especially like the door handle recessed inside the door panel the way it is. My hand just falls in there naturally. And there's no chance of catching your clothes there, either. Pontiac shows good sense in having a foot-operated parking brake.

I know that several other auto makers offer the same type of car now, but Pontiac has the "hot car" image going for it. That's what they'll capitalize on.

Pontiac hasn't pinned a price on this job yet, but if it comes within $100 of a comparable Camaro, it's a good buy. Remember, I liked the styling of the Camaro with the RS package, but I think this car is even better looking up front. PS

Goodrich Space Saver spare is inflated by aerosol can. It's said to be good for 1,000 miles. It can get you home, and it deflates to store again.

Facts on the Pontiac Firebird 400

DIMENSIONS (inches)	
Wheelbase	108.1
Front track (disk brakes)	59.2
Rear track	59
Length	188.4
Width	72.6
Height	51.6
ENGINE	
Type	OHV V-8
Displacement	400 cu. in.
Bore & stroke	4.12 x 3.75 in.
Compression ratio	10.75:1
Carburetion	Single 4-bbl.
Horsepower	325 @ 4,800 r.p.m.
Torque	410 lb.-ft. @ 3,400 r.p.m.
CHASSIS	
Transmission	Automatic 3-speed
Axle ratio	3.08:1
Brakes	Disk/drum
Brake-swept area (front)	8.50
(rear)	119.4
Steering ratio (overall)	24:1
Turning diameter	36.75 ft.
Curb weight	3,855 lb.
Tires	Goodyear Wide Tread E70-14

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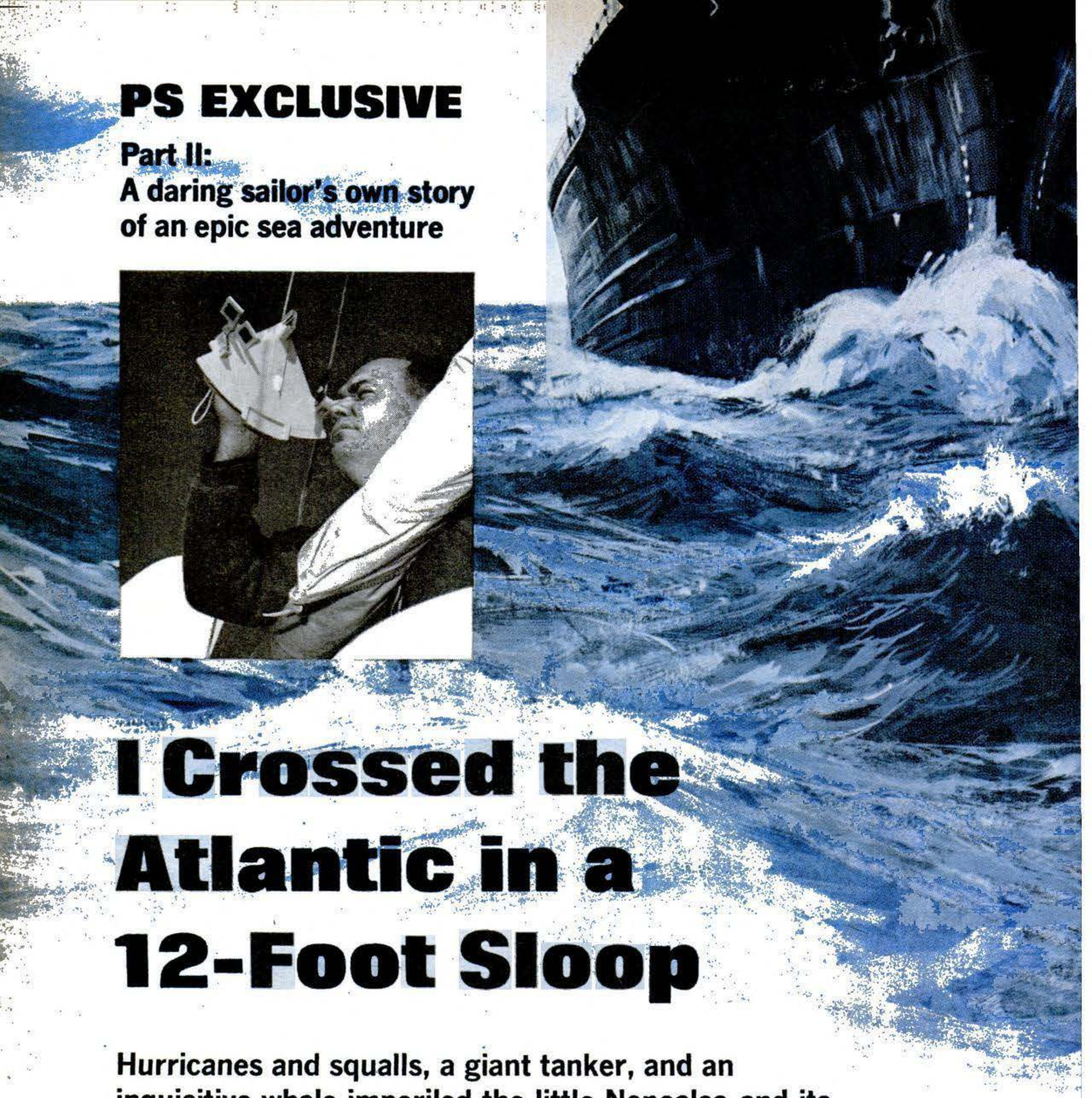
PS EXCLUSIVE

Part II:
A daring sailor's own story of an epic sea adventure



I Crossed the Atlantic in a 12-Foot Sloop

Hurricanes and squalls, a giant tanker, and an inquisitive whale imperiled the little Nonoalca and its skipper on the 65-day voyage from Florida to Ireland

By WILLIAM E. VERITY ILLUSTRATIONS BY GIL COHEN

COULD be I'm bad-weather prone, the way some people seem accident prone. Before setting out on the greatest adventure of my life, I had to wait three days for good weather. It lasted just one day!

But that 8th of May, 1966, was fine, with a moderate southeast wind. Mayor Ed Burry of Ft. Lauderdale, Jack Lively, who got an official *Notice to Mariners* put out about me, a few other friends, and a reporter were aboard the tug Escort that towed me out of Port Everglades.

I had insisted on the tow because Capt. Elwell Thomas of the Escort keeps a documented log. In this my departure was officially noted as he released my boat, the Nonoalca, at the sea buoy.

I got under way at 12:30 p.m. Psychologically, it was a low point.

Besides the question of survival, was the

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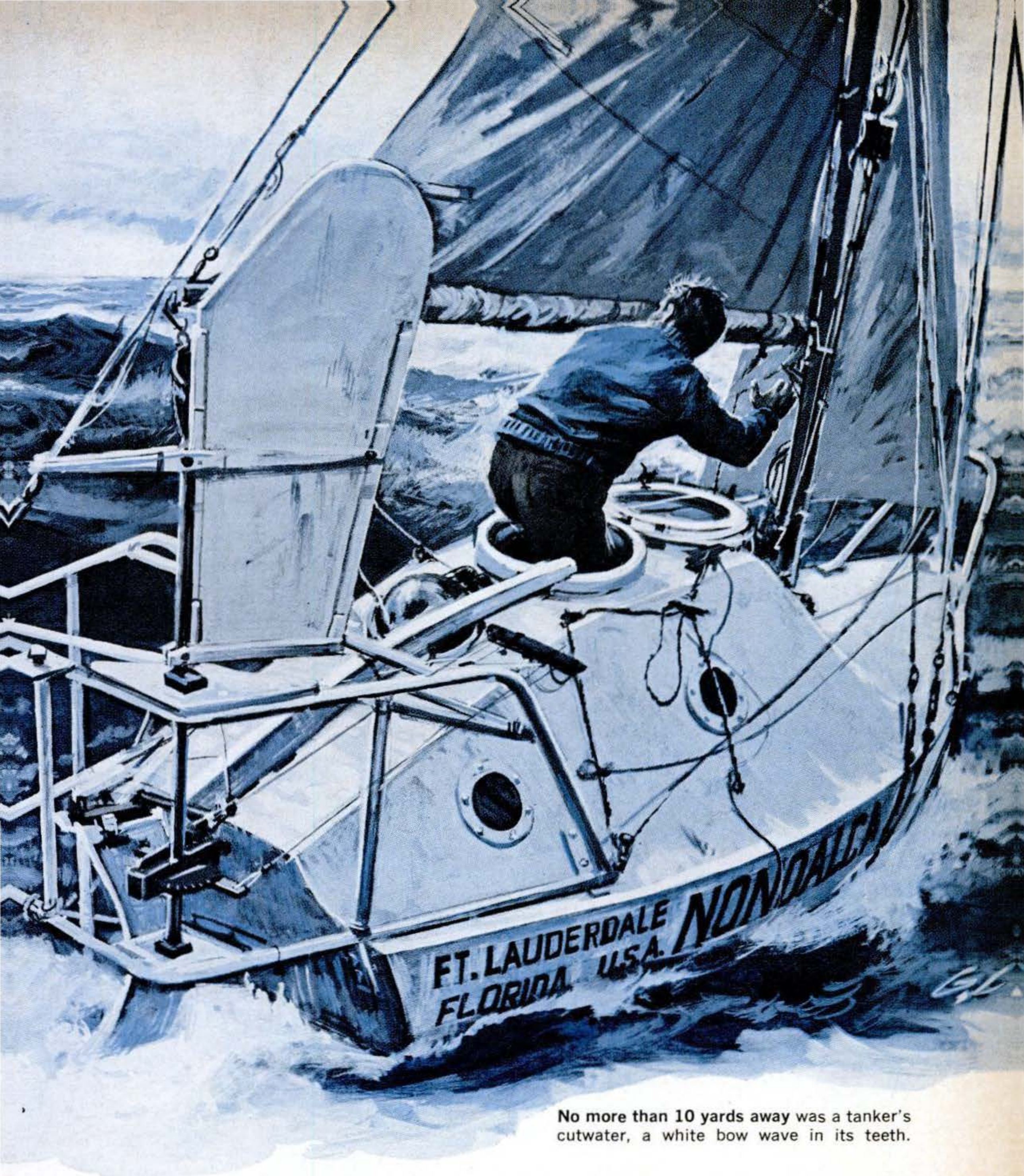

No more than 10 yards away was a tanker's cutwater, a white bow wave in its teeth.

trip worth making? What had started me on it was evidence, in legend and in ancient New World relics, that a monk named Brendan had sailed from Ireland to Florida in the Sixth Century—long before Columbus, even before Leif Ericsson. There is no proof, but I'm of Irish descent, my family has built boats since 1644, and I was out to duplicate Brendan's passage home. Was it a suicide try?

Such doubts weren't new to me. They had come on the start of a long voyage across the Gulf of Mexico, too, so I knew what to expect. This time it took longer—four days.

Then, suddenly, I was free of doubts. It happens that way.

Everything falls into place as your aptitudes and training take over. Whatever

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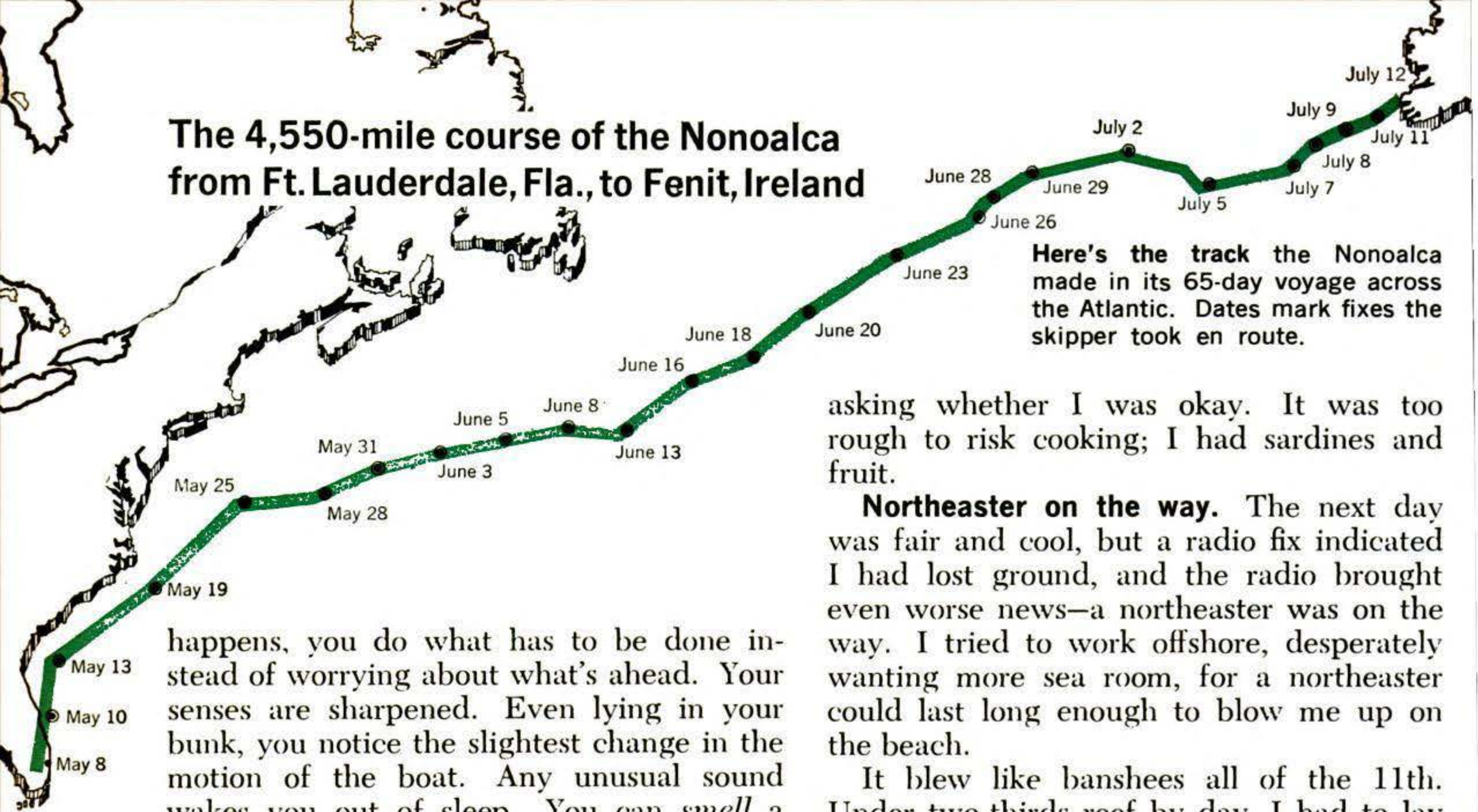
The 4,550-mile course of the Nonoalca from Ft. Lauderdale, Fla., to Fenit, Ireland



Here's the track the Nonoalca made in its 65-day voyage across the Atlantic. Dates mark fixes the skipper took en route.

happens, you do what has to be done instead of worrying about what's ahead. Your senses are sharpened. Even lying in your bunk, you notice the slightest change in the motion of the boat. Any unusual sound wakes you out of sleep. You can *smell* a ship downwind long before you see it. I've smelled land a hundred miles away.

Three miles offshore, the spinner of my taffrail log was snagged by a fishing boat I thought was going to pull ahead but didn't. That meant I could only estimate speed for future dead reckoning.

First night out. Sailing northeast as night fell, I saw the loom of Palm Beach—that dome-shaped glow from a city's lights you can often spot 50 miles away. Darkness activated the solar switch of my signal light. This was a blinker of the kind used on construction work, fixed a third of the way up the mast. Its brilliant amber flash lit the deck, mainsail, and jib, revealing to other mariners not only the boat, but by the set of its sails its course and position. A battery lasted 30 days, being turned on automatically by darkness.

Too keyed up to eat much, I had hot tea and canned fruit. Near midnight I took a one-third reef in jib and mainsail, engaged the automatic pilot, set the alarm to wake me at four, and turned in.

On waking, I got an approximate radio bearing and took a sight of Polaris for latitude. Still clear then, the weather turned sloppy at daybreak, and downright bad off Bethel Shoal. The radio spoke of a squall line, loaded with tornadoes.

Reefed down, I was making four knots, which with the Gulf Stream's three gave me a speed of seven over the bottom. I had hopes of getting out of the squall line. A tanker pulled up astern and hailed me, asking whether I was okay. It was too rough to risk cooking; I had sardines and fruit.

Northeaster on the way. The next day was fair and cool, but a radio fix indicated I had lost ground, and the radio brought even worse news—a northeaster was on the way. I tried to work offshore, desperately wanting more sea room, for a northeaster could last long enough to blow me up on the beach.

It blew like banshees all of the 11th. Under two-thirds reef by day, I had to lay to under bare poles, with the sea anchor out, all that night. It was too rough to cook or even to sleep. Next day, with the wind east at 15 m.p.h., I caught up on my sleep. But a ground swell from northeast promised more squalls.

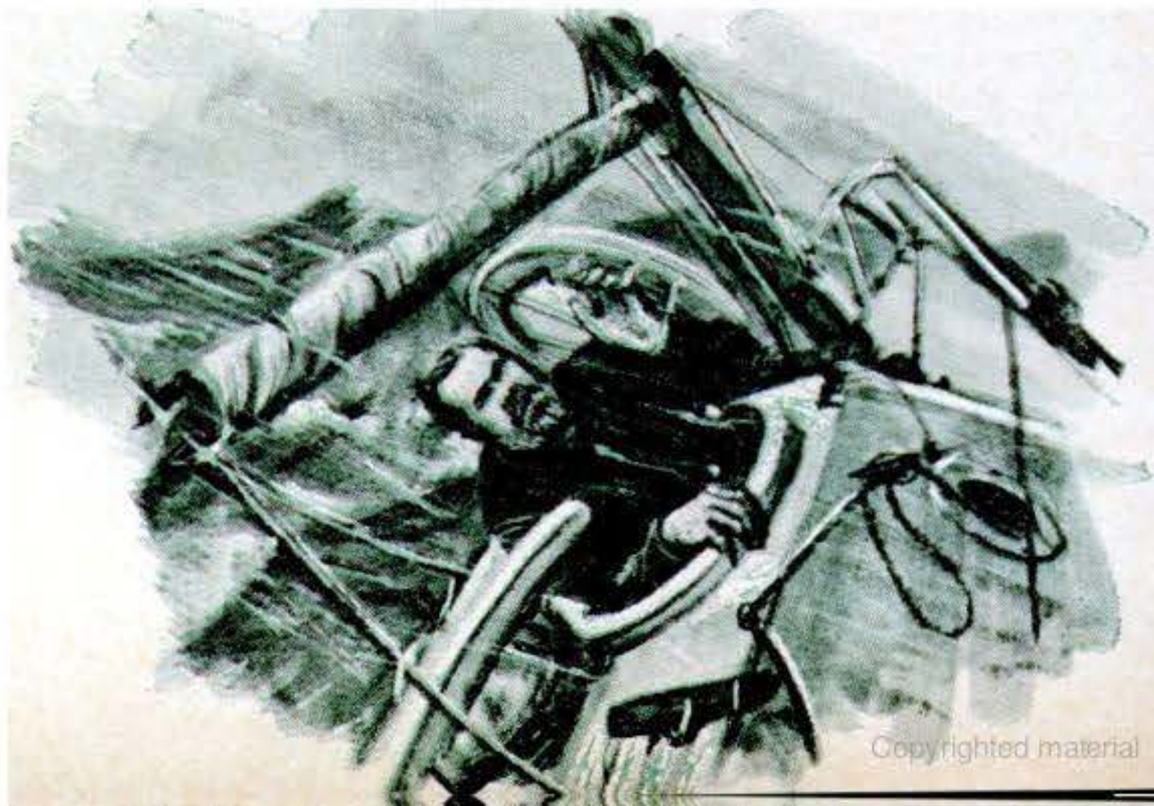
My log for the 13th of May reads:

Rained all night. As of today I've weathered seven squalls. Dolphin around the boat this morning. A radio check placed me 125 miles due south of Cape Romain. Course NE. Fried some bread for lunch. Real good! My compliments to the chef.

My radio direction finder was newly installed. Calibrated on a horizontal plane, it was unreliable in rough weather. (Compensated RDFs cost more than I could afford.) I had a radio receiver that gave me time signals for navigation, as well as weather reports, but no transmitter.

Off Cape Hatteras, the night of May 14th was a hell of rain, wind, and lightning. By daylight the seas were still chop-

Strong gusts knocked the boat down three times before I could get all sail reefed.



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py. I was under sail, sitting in the cockpit looking at some suspicious clouds, but they weren't ragged, as they usually are when strong winds are coming.

It was therefore without a hint of warning that a 50-mile gust hit the boat and knocked it flat in the water. I snapped the hatch shut from inside to keep out the sea. As the gust passed and the boat came up, I opened the hatch and hastily started to reef sail. Almost immediately another gust struck, again slamming the boat down. I got back inside and closed the hatch, standing on the lockers to hold it shut. When the wind let up I rushed out to finish reefing. Before I could do so, a third gust smacked the boat flat again but I was able to get all sail down.

Waiting for winds. I got little sleep until the next day, when the seas subsided. But the wind had turned northeast, and though a weather report promised southwest winds, by late afternoon I was still waiting for them. I used the time to clean up, shave, read, and sleep.

That night I was becalmed, but next day the Nonoalca bowled along before a gentle SE breeze in fine weather. I celebrated with a meal of steak and papaya chunks.

On May 19th, I had a refreshing bath on deck and was lying down. Suddenly a shattering blast of a ship's horn shook the hull around me. I shot out of the hatch. No more than 10 yards away was the enormous cutwater of a tanker with the bone of a bow wave in her teeth.

Instantly I swung the tiller hard over. If I hadn't jibed—come about downwind—instinctively, we would have hit. The ship's secondary wave help me around, and then her helmsman kicked the ship's stern over. We scraped by with little to spare. My guess is that she must have overtaken me on a parallel course, then turned toward the Nonoalca to investigate. But whoever was on the bridge misjudged speed, and had us on a collision course.

The voyage was uneventful then until somewhere off the Grand Banks a big whale leaped clear out of the water near my boat. It fell back with a crash like a bus falling down a gully.

The chores. On good days at sea, on waking, I usually checked course, wind direction, and weather, turning on the radio to listen for reports and static—itself often a warning of storm. I'd light the stove to warm the cabin and boil water for tea, brushing my teeth, and washing. (I gave up shaving, but combed my hair and beard daily.)

In fog and darkness, water phosphorescence made porpoises look like flaming torpedoes.

Then I would plot my dead-reckoning position, do chores, and read until noon. This was the time for a navigating sight and a snack, after which I checked rigging.

Several times a day I'd stand on top of the cabin and watch for ships. Other times I'd nap or read, occasionally aloud just to hear a human voice. A slight heel of the hull and rattle of the wind vane, signifying

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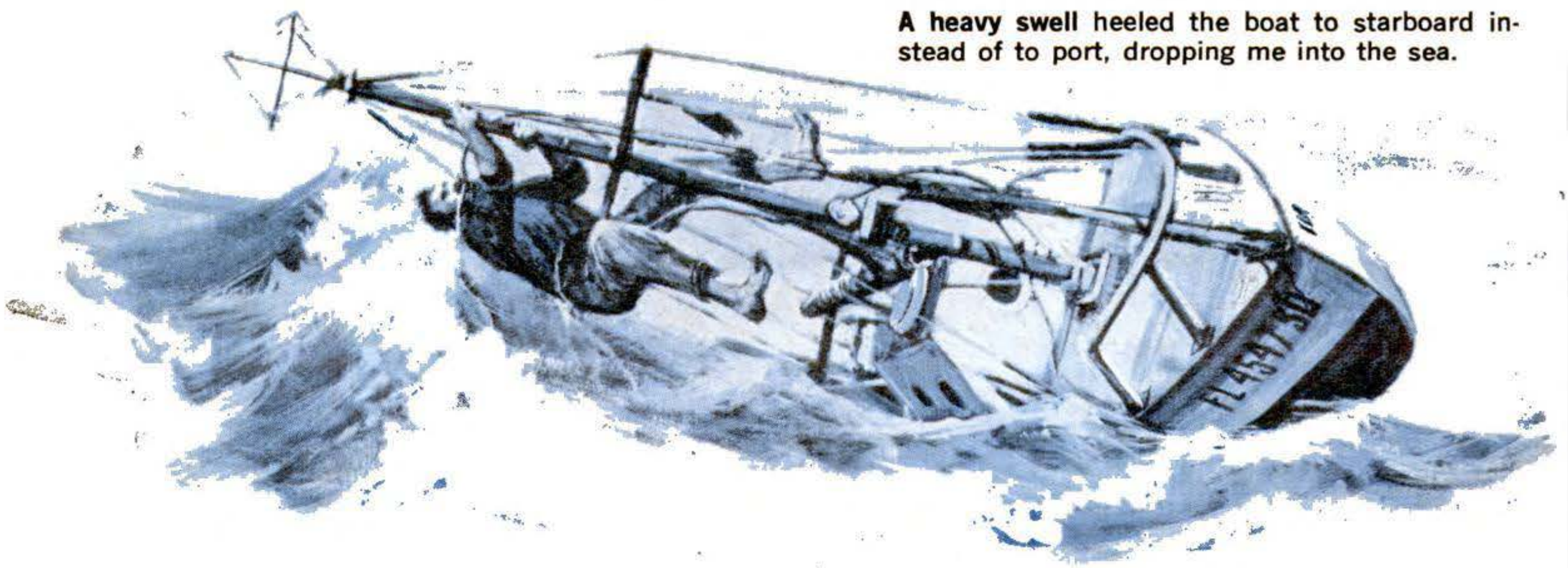

A heavy swell heeled the boat to starboard instead of to port, dropping me into the sea.

a shift in wind, would bring me out to put the boat back on course, reset the sails, and readjust the vane.

Local sunset time gave me a latitude check. After listening to marine broadcasts, I usually got to sleep by 10 p.m. When the alarm woke me four or five hours later, I'd check course and weather.

Steaks at sea. For cooking I had a deep seven-inch frying pan and a six-quart saucepan, with one lid fitting both. Canned soups were thickened with rice or potatoes. Boiled rice with vegetables and sardines or canned meat made a solid meal. Canned oysters or clams, powdered milk, and clam juice became delicious chowder. I made pan bread of self-rising flour, powdered milk, salt, and water, "baking" it in the frying pan; sometimes I added raisins or fruit.

But the gastronomical high spots were freeze-dried canned meats given me by Bill Thomas, whose 52-foot schooner I had helped sail to the Bahamas. He supplied me with steaks, pork chops, hamburgers, ham and eggs, finnan haddie, and fruit. It's quite a luxury, after riding out a gale, to enjoy a steak or pork chops 2,000 miles from the nearest supermarket.

I had canned fruit, shellfish, and rice pudding, and for sweets honey and marmalade. Fresh water was carried in half-gallon card-board boxes with plastic liners.

May 24th blew up a wild squall, with 50-mile winds. Suddenly the jib halyard parted, and away went the jib. I sailed under reef main alone and had to steer by hand. When the wind and seas moderated, I tied an eye splice in a ⅜-inch nylon line. The problem was reeving it through the block at the masthead—much like threading a needle 19 feet high stuck in a floating cork.

Finally I stuffed lockers with towels and blankets to keep stores in place, stripped to shirt, pants, and boat shoes, lashed the hatch down from outside, and reefed the mainsail.

Holding the halyard, I stepped on the gooseneck and signal-light bracket. As I reached for the spreader, the boat began to heel over under my weight. When my hips were at the spreader, the mast dipped into the sea, plunging me in, too. It was bitterly cold. With one hand I reeved the halyard, then reversed my passage down the mast. No more than a gallon had leaked into the cabin. I bailed it out, lit the stove to warm up, and was soon under way.

A big whale leaped clear, then fell back with a crash like a bus falling into a gully.

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On the 29th of May, a strong wind made me lay to from midnight to daylight. Being short of sleep, I was catching up when suddenly awakened by loud voices and the clank of metal. Sitting up, I saw a huge wooden wall outside the port.

I opened the hatch and jumped out. A man on the deck of a ship was trying to grapple the bow rail of the Nonoalca. Others stood by in open-mouthed amazement. I yelled something salty, and the ship—a swordfisherman out of Nova Scotia—sheered off. On the marine radio later I heard the captain speculate about what he'd tried to gaff—he wondered if it was a cartop boat, some kind of spacecraft, or a king-size toy.

My next encounter was happier. On May 31st, I ran across a long-liner's fishing buoy. These boats put out up to 20 miles of line, with as many as 25,000 hooks, supported by buoys. By 10 a.m. I was aboard the M. V. Margaret R.M. II, eating corned beef, while the Nonoalca sailed alongside on a line. Captain Mils, out of Halifax, invited me to stay for dinner and I did.

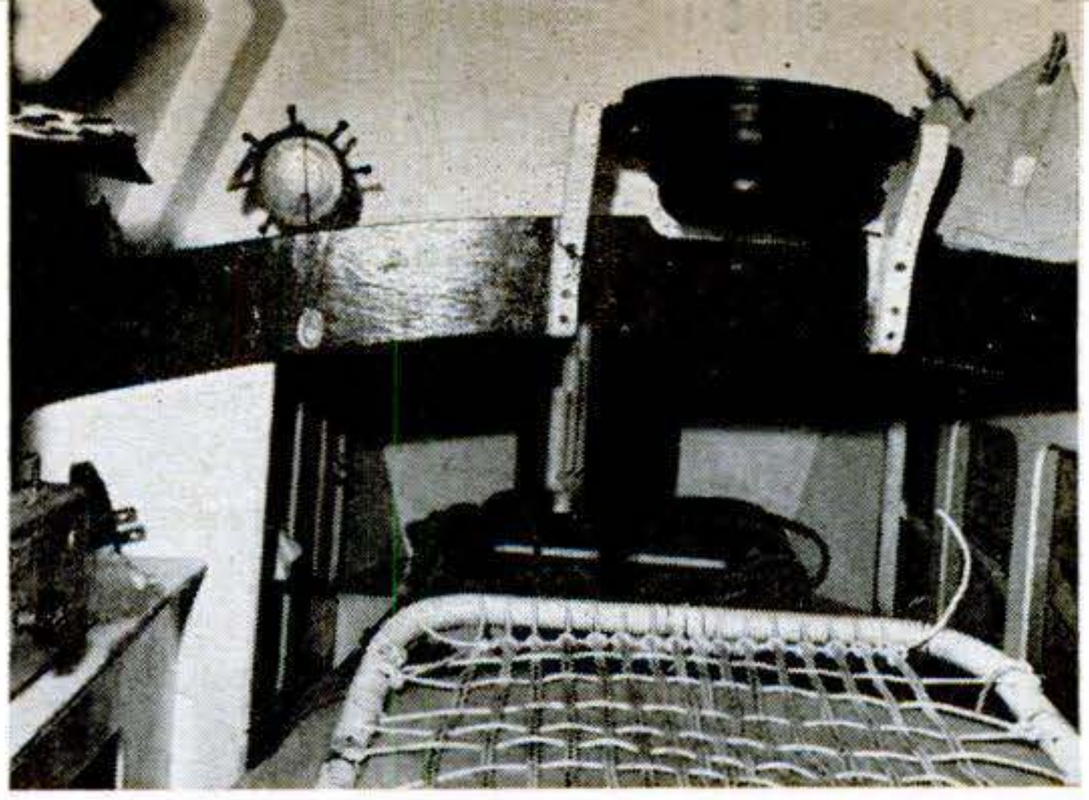
Alma arrives. After several days of fair sailing, the seas turned choppy and the sea anchor went out on June 9th. It was a wild night of rain and huge seas, but next day I was becalmed in a cold rain. On the 11th, the radio warned of gale winds from hurricane Alma. I reefed down to bare sticks, put the sea anchor out, and lashed the tiller.

The next day and night were probably the worst I have ever known. It was impossible to eat, sleep, or even rest. The boat was tossed from crest to gully like a seagoing yo-yo. I could only hang on and listen to the roaring seas crunch against the hull. I wondered about the two British paratroopers who were trying to row across the Atlantic from Maine.*

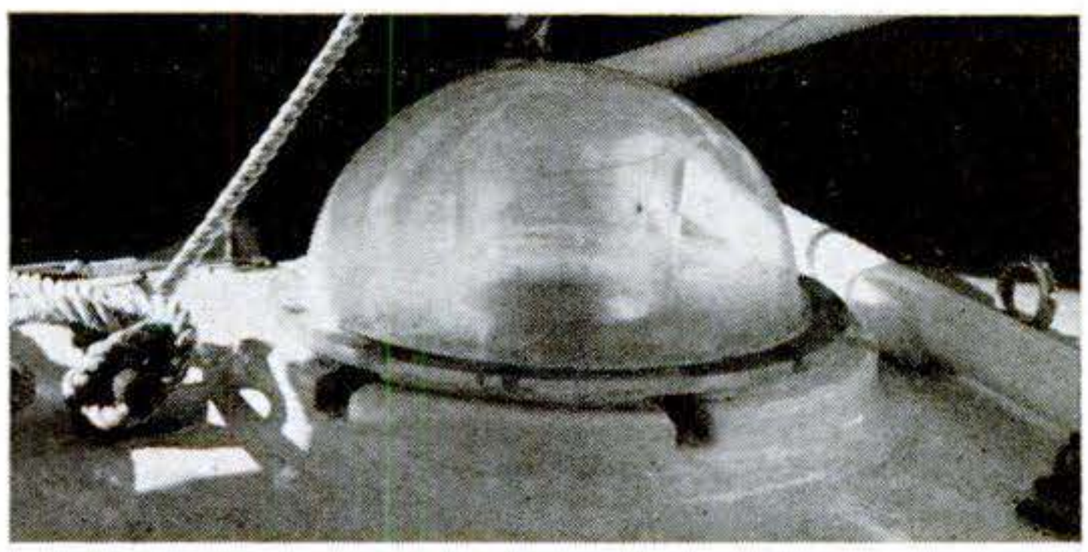
On June 13th I got under way again. Some shrouds had let go on the sea anchor and the boat was a mess inside. After cleaning up, I got some sleep. That afternoon a whale blew about 100 yards from the boat, with a noise like a freight train's air brakes. A freighter gave me my last position check.

Fog and phosphorescence. A few nights later I was awakened about 2:30 a.m. by a foghorn. The night was jet black, with fog like pea soup. But the boat left a fiery wake; two porpoises weaving under and about me looked like flaming torpedoes.

They encountered Alma 12 days out, 180 miles east of Boston. They landed in Ireland in a gale on Sept. 3, 1966.



Here's a view of most of Verity's snug little cabin on the Nonoalca—compact, but dry and warm.



This little Plexiglas blister covered the sloop's breathing vent. It allowed air in, kept water out.

The foghorn sounded again—much too close for comfort. I could see nothing of a ship, but blew my own whistle repeatedly until the foghorn was astern. I have no idea how close that ship passed, but sailing in fog is a sporting substitute for Russian roulette, and it lasted all night. (Next morning the radio announced the sinking of a trawler by a Liberian freighter.)

By five that afternoon the fog was thick as ever. I heard no more horns, but altered course to get out of steamer lanes.

On June 20th, I had a visitor. My bird book identified him as a barn swallow, and I took a photo to prove it.

Reefed down for a gale on June 23rd, the jib halyard parted again. There were still squalls and I hated to go overboard to reeve a new one, even wishing I had a trained bird to fly the line through the block. Once I tried to climb the mast, but a big sea against the hull nearly threw me off when the mast whipped back.

On the 25th, the swell was still too heavy, and it rained all day. An east-bound cruise ship, agleam with portholes, flashed a spotlight on me that night. At six the next morning I climbed the mast.

The heavy swell laid the boat over to

[Continued on page 208]

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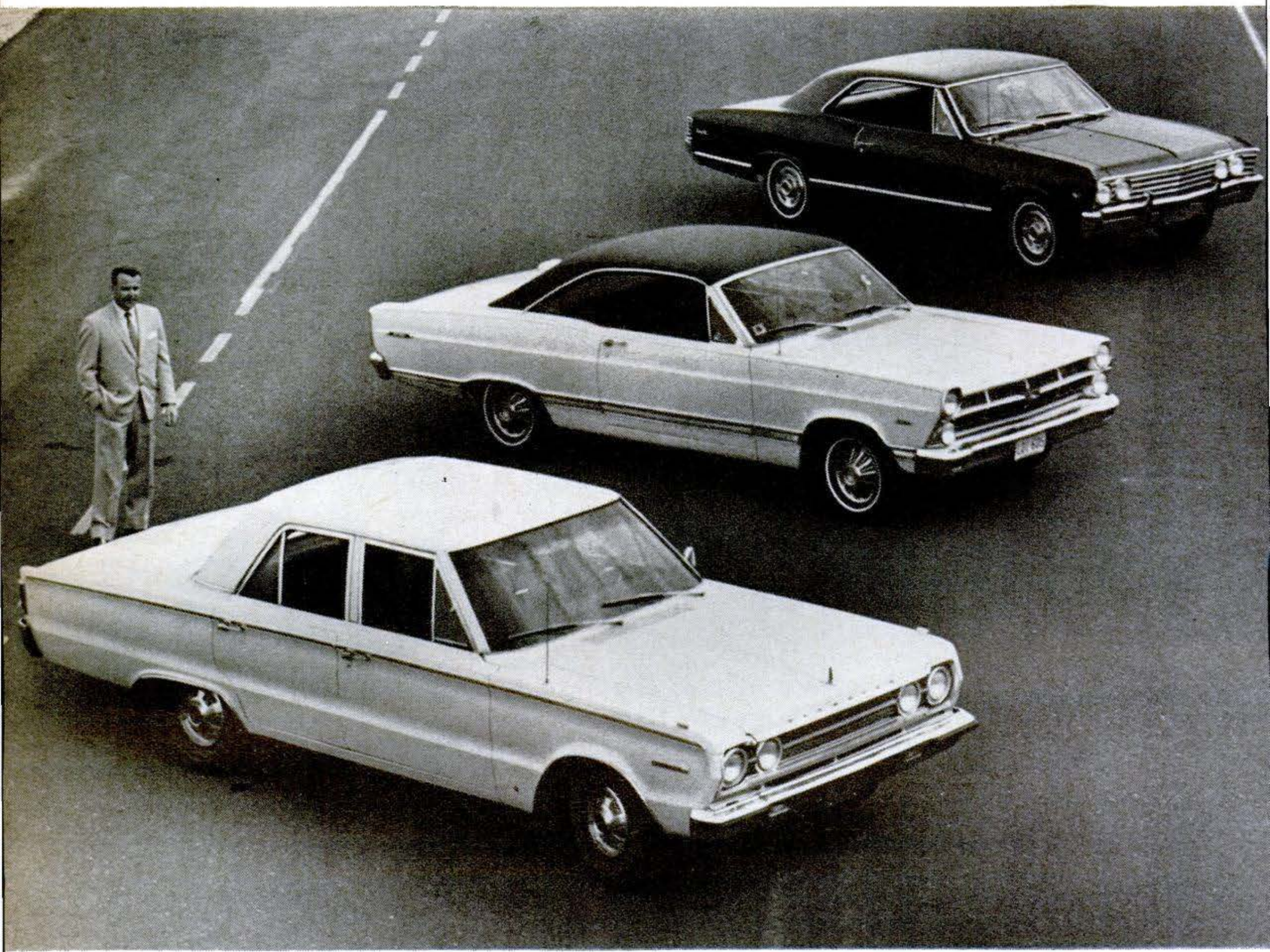
The ever-more-popular intermediates:

Chevrolet's Chevelle, Ford's Fairlane, and



Belvedere (foreground) and Fairlane (middle) have unit bodies; Chevelle (top), separate frame.

By JAN P. NORBYE / *PS Automotive Editor* PHOTOS BY BILL MORRIS

Chevelle, Fairlane, and Belvedere are the top three intermediates. This year, they will make up 12½ percent of all new cars. Chevelle is the most popular, outselling the Fairlane almost two to one and the Belvedere better than 2½ to one.

We asked the manufacturers for two-door hardtops with V-8 engines of about 200 hp., automatic transmission, power steering, and power brakes. The nearest thing to it that Plymouth had available was a 230-hp. four-door sedan, but the Ford and

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A successful compromise between size and style, power and economy, the in-between cars are winning sales from both standards and compacts

ymouth's Belvedere

the Chevy were very closely matched. The Belvedere came with heavy-duty springs and without power brakes. The benefits of its stiffer suspension showed up in the handling tests.

How important are these tests? Very. A car does not spend all its useful life traveling in a straight line. It makes turns all the time, some long and easy, others short and sharp. The driver plans most of these turns. He also makes some turns as a reflex to avoid sudden obstructions on the road. He can't always match car speed to the severity of the turn.

In addition, the car originates some turns itself: in hard crosswinds, on slippery roads, or in response to changes in road camber. When that happens, the driver must make steering corrections. The car that responds with the highest precision at speed (or successfully tackles a specific test at the highest speed) also has the highest margin of handling safety at lower speeds. This is important in any unexpected situation. In an emergency, it may make the difference between a narrow escape and an accident.

The handling tests. I take each car through three handling tests. The first is a long constant-radius turn. The slalom simulates tight traffic or a narrow mountain road, calls for frequent steering reversals, and 25 m.p.h. is about tops.

The Fairlane understeered badly and called for too much wheel movement to do better than 24; and power-steering failure to keep up with wheel movement limited the two others in the slalom.

The wiggle-woggle is a high-speed lane change, two ways in a matter of seconds. This really shows if a car is well balanced or not. Plymouth was fastest by a wide margin (see photos).

The constant-radius turn is used to establish the maximum side load a car can

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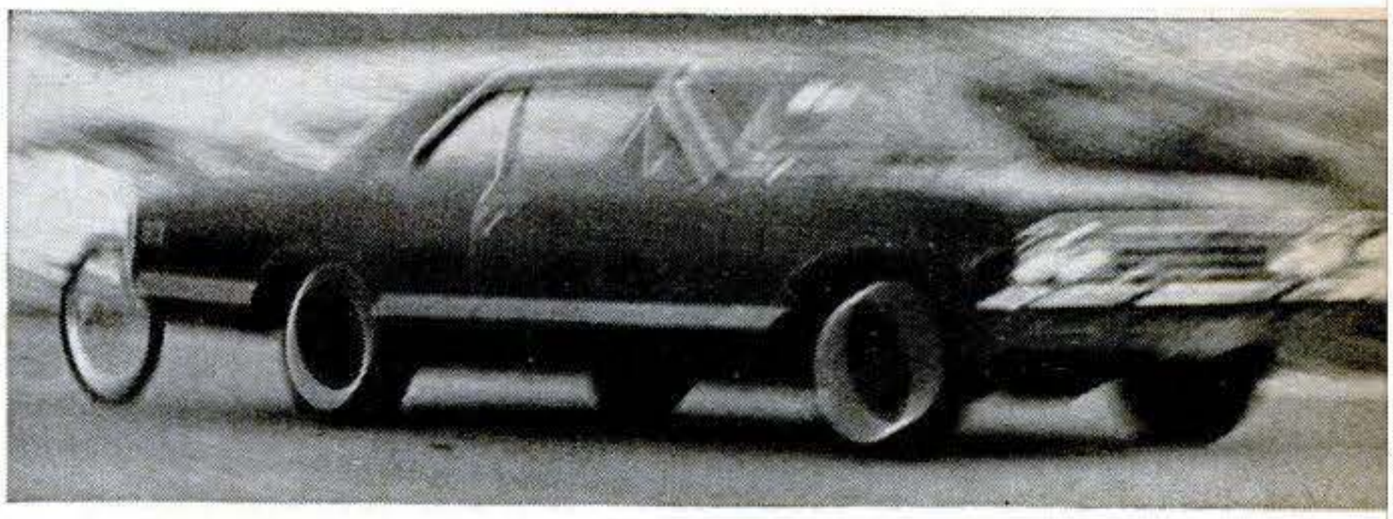
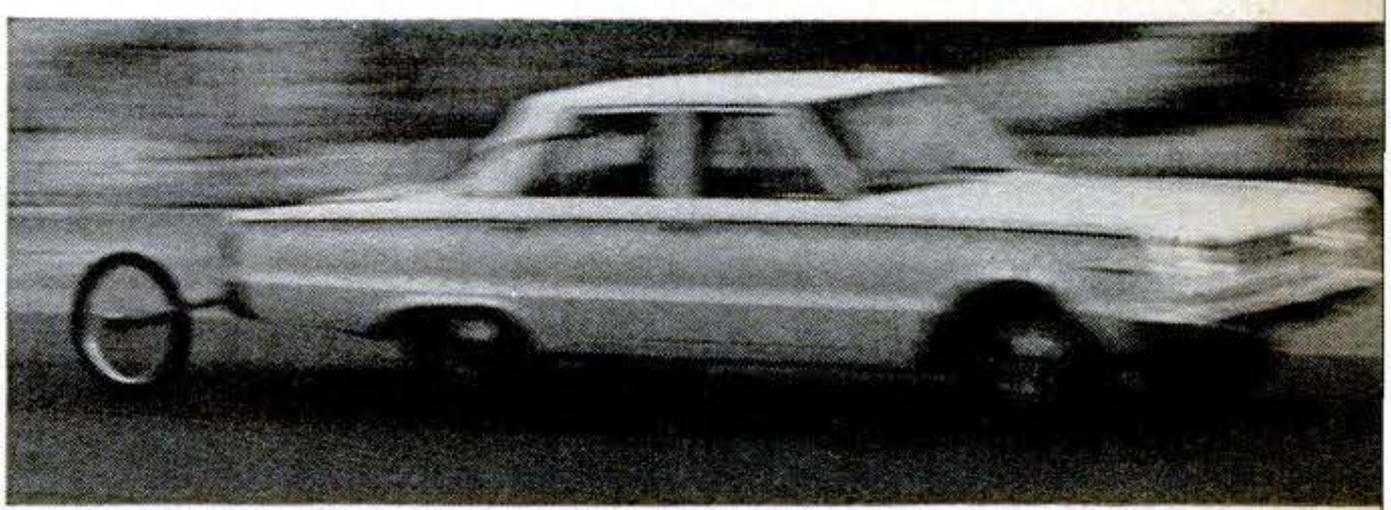
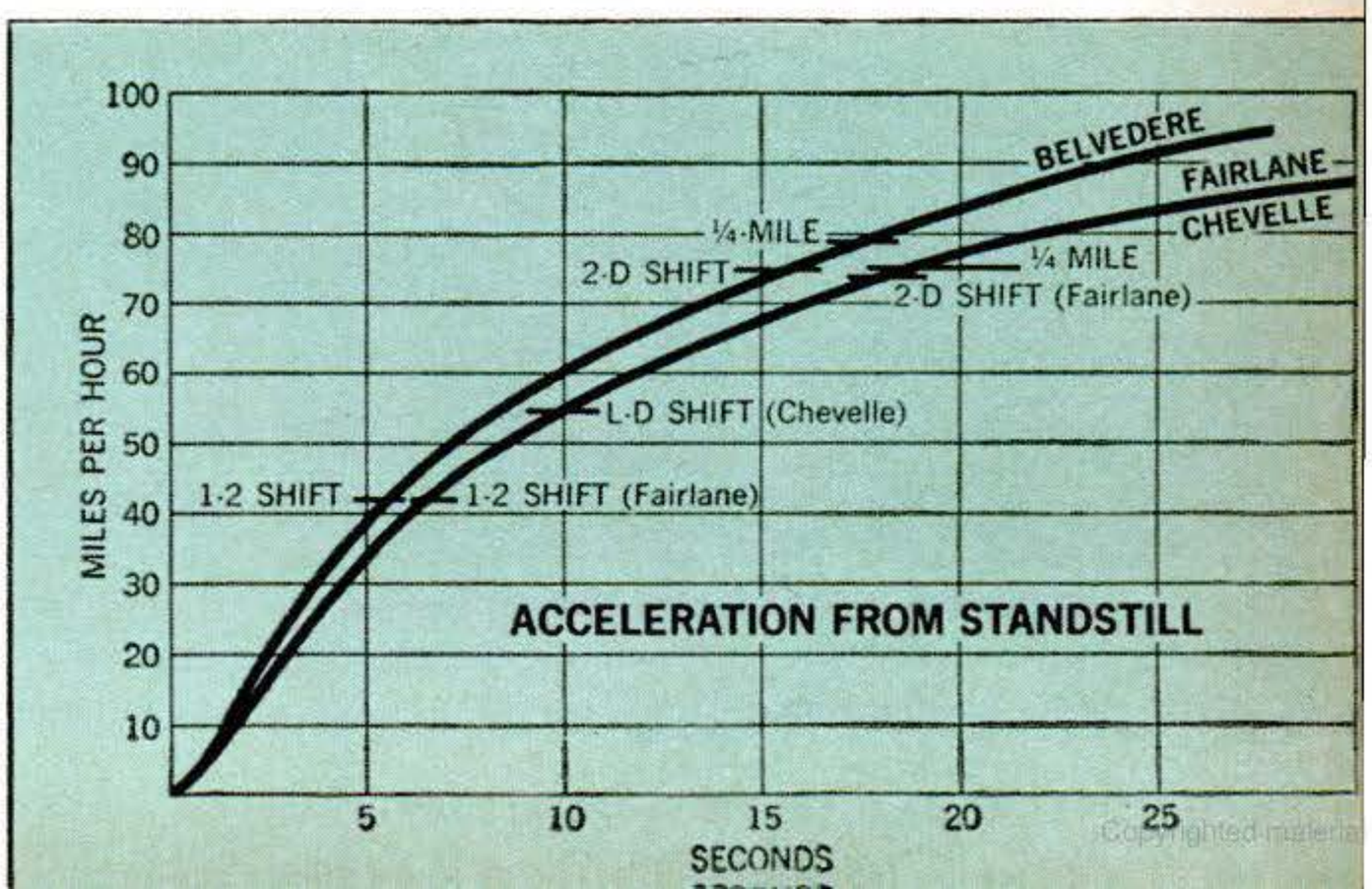


Chevelle did 25-70 m.p.h. in 13.8 seconds. Transmission failed to give kickdown into low range.

Fairlane went from 25 to 70 m.p.h. in 12.3 seconds, using low range to 42 m.p.h., intermediate to 70.



Belvedere got kickdown to intermediate but not low range. Still it did 25-70 m.p.h. in 10.6 seconds.



Chevelle: rear-wheel locking imminent.

Fairlane: nosedive and rear lockup.

Belvedere: stable braking action.

	CHEVELLE	FAIRLANE	BELVEDERE
	259 FT. 75 LB. .66g MAX.	214 FT. 45 LB. .63g MAX.	216 FT. 120 LB. .72g MAX.

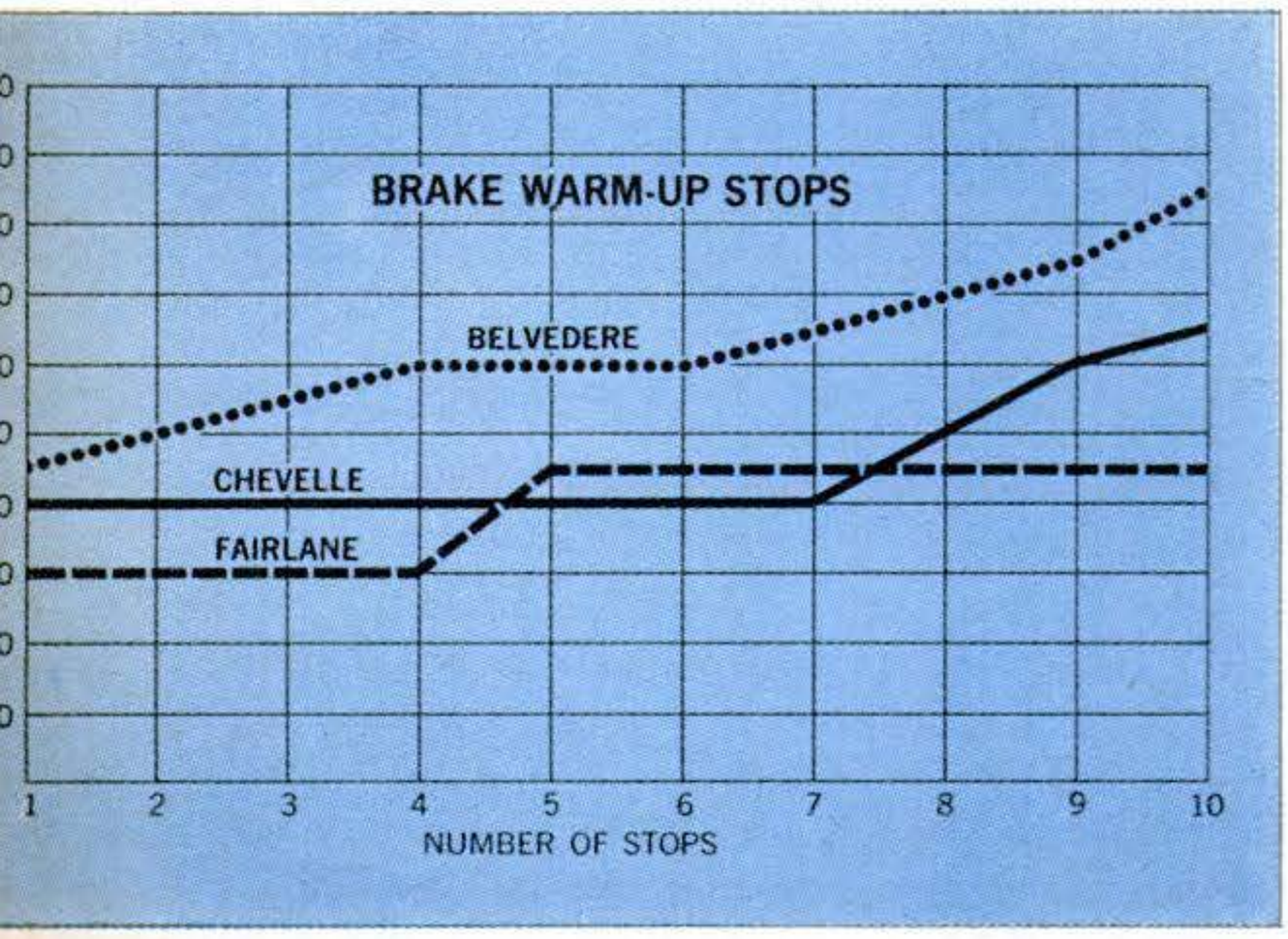
Chevelle and Fairlane had power brakes; the Belvedere did not. All three cars had drums front and rear, and all got very hot but not erratic. Fairlane shows best fade resistance, Chevelle least.

Chevelle: pump catch set in at 25 m.p.h.

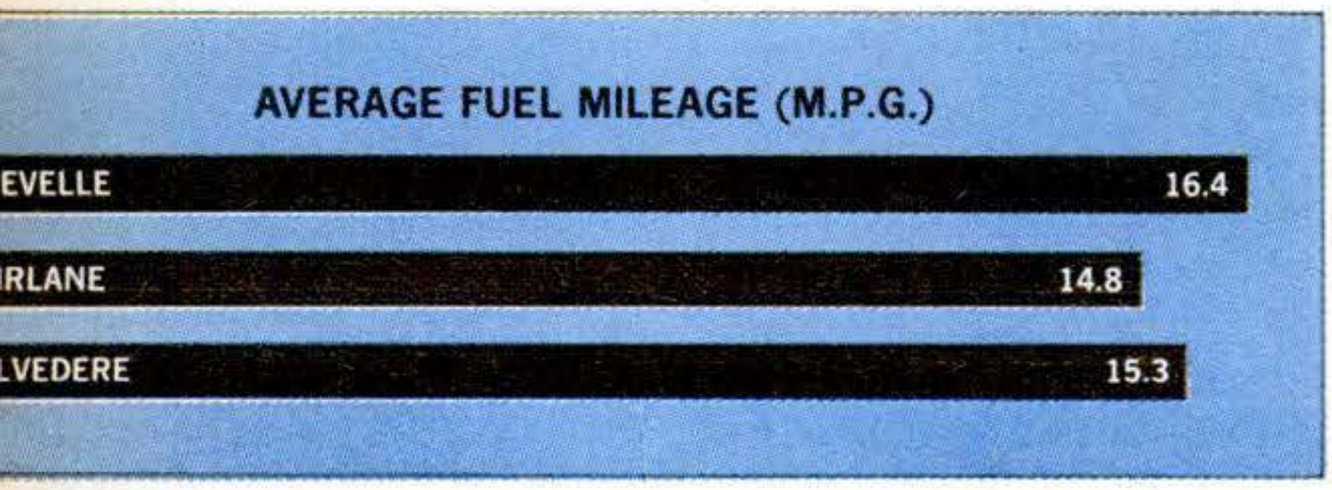
Fairlane: out of control at 25 m.p.h.

Belvedere: beginning pump catch above 26.

Slalom is sharp-turn test with quick steering reversals. Pump catch (power assist lagging behind wheel movement) limits the speed on many cars. Fairlane needed work with the wheel to keep up.



Warm-up stops are made from 60 m.p.h. with 0.5 g retardation at timed half-minute intervals.



Gasoline mileage includes all tests. You should be able to better our average mileages considerably.

take and remain under control. Side loads can be measured as lateral acceleration, and readings are made in fractions of one *g*. One *g* is the rate of acceleration of a free-falling body in vacuum. It is equivalent to 32 feet per-second-per-second.

Lateral acceleration of one *g* means that a force equal to the car's weight is trying to push it sideways off the road. A side force of 0.65 *g* is considered the most you're likely to meet in road driving.

The turn used for this test has a 255-foot radius. From an entry speed of 55 m.p.h., the car accelerates through the turn until maximum side load has been established. Each car gets several runs to cancel differences in driving—such as steering-wheel and throttle movements.

The Chevelle felt steady with a sustained side force of 0.82 *g*. The Belvedere reached 0.85 *g* and was easier to drive near its limit because it needed less work with the steering wheel. Not only is the ratio quicker but the slip angles in the Plymouth's rear tires build up and keep the whole car in a balanced state. The Chevelle had slight understeer throughout. That is okay, too, for understeer is a stable motion and can be diminished by backing off on the

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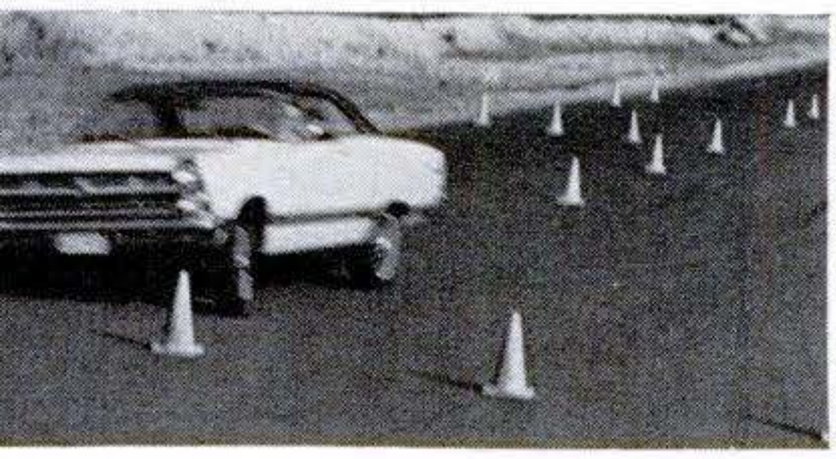
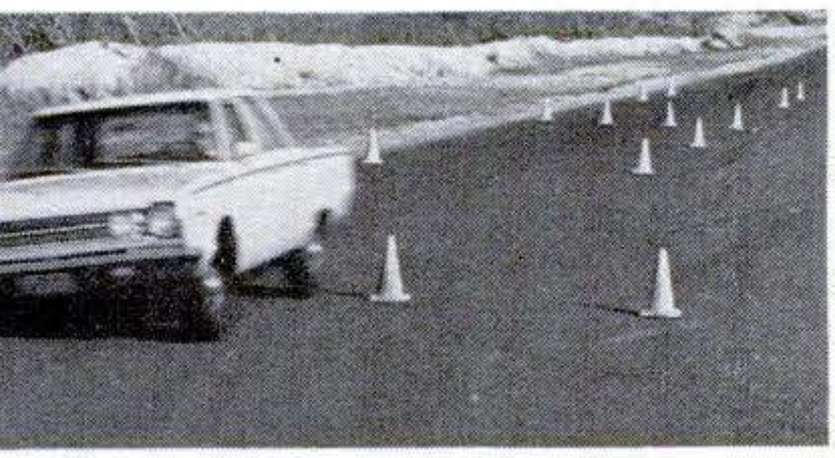
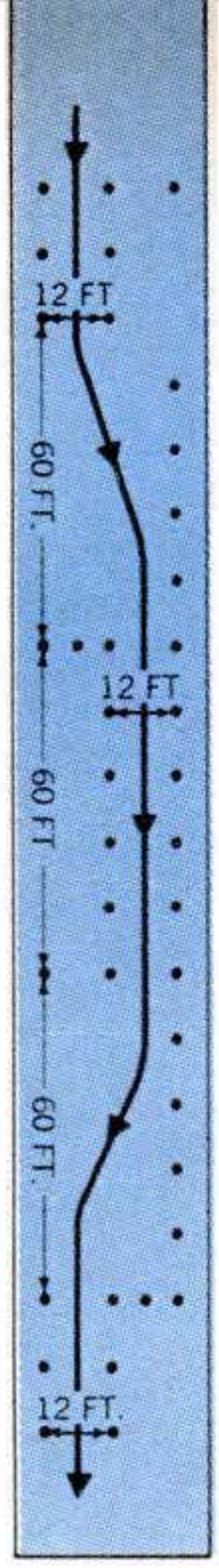
Chevelle: 55 m.p.h. in wiggle-woggle.



Fairlane: okay at 55, failed at 57.



Belvedere: several clean runs at 60.



Wiggle-woggle simulates high-speed lane change. Chevelle lost both of its front hubcaps due to wheel bending. Fairlane understeered. Belvedere did one clean run at 65 m.p.h. with some tail-wagging.

throttle. The Fairlane understeered more firmly and could not exceed 0.80 g except momentarily—then the front tires would rub sideways and the car would lose speed—and therefore, side force would fall off, too.

Brakes. Brakes in the intermediates generally proved inferior to the brake systems in larger cars we have tested this year. The shortest stopping distance (after warm-up) with an all-drum-brake car was recorded by the Pontiac Catalina [PS, Jan.] with 179 feet. All brake tests are made from 60 m.p.h. without locking any wheel.

None of the intermediates could come close, all three taking over 200 feet from 60 m.p.h. to standstill. It's noteworthy that the Chevelle, poorest of the intermediates, still stopped better than its big sister, the Impala, needing 26 feet less to come to a full stop.

It was no surprise that the Belvedere, with its 318-cu.-in. V-8, was faster off the mark than its Ford and GM rivals. But I was surprised that the Chevelle and the Fairlane ran the whole quarter-mile side by side. The higher-revving Chevy 283 with Powerglide was a beautifully even match for the workhorse Ford 289 with three-speed automatic transmission.

Belvedere's back seat is a half-inch wider than Chevelle's, 0.9 inches wider than Fairlane's, and seats four pre-teen girls in comfort.

More People Are Choosing Intermediates for Family Use

By JIM DUNNE / *PS Detroit Editor*

Intermediate cars were unheard of five years ago, but today they account for one of every five new-car sales. These middle-size cars offer a sound transportation package that features adequate passenger and luggage room, a variety of engine choices, moderate outside dimensions, and good driving comfort. Intermediates are built for general everyday use. They are big favorites with family men and fleet operators.

Belvedere's best feature is its fine all-

Continued

Biggest complaint against Fairlane is position of brake and accelerator pedals. You cannot easily swing your foot around on the heel.

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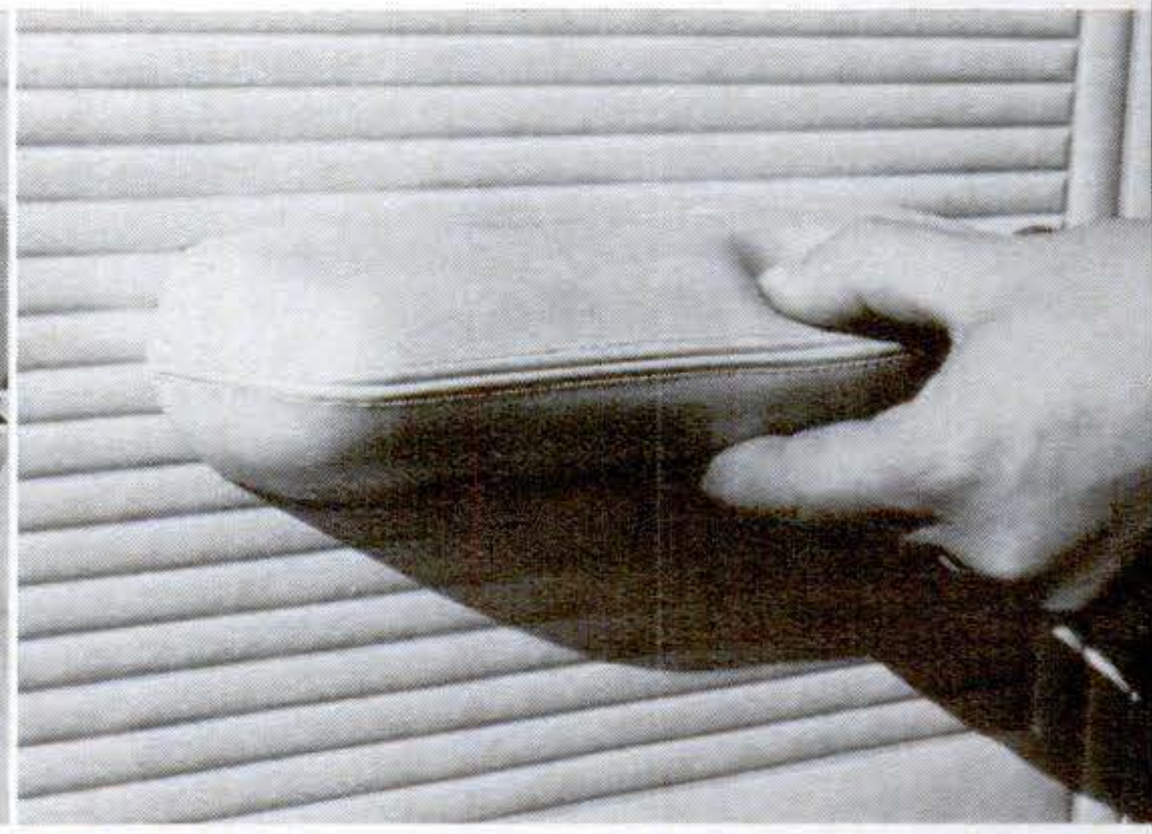
around soundness of body construction. It's a solid, quiet car uith good usable room inside. In the Chevelle, I was most impressed with the firm, quiet ride; it's the one car that uses separate body and frame construction. Chevelle's firm ride reduces sway in turns to almost nothing, and produced the best ride at highway speeds. Fairlane's ride is the harshest, but it is no more than extra firm. Belvedere has a firm ride, too, but it feels like a lighter car than Fairlane.

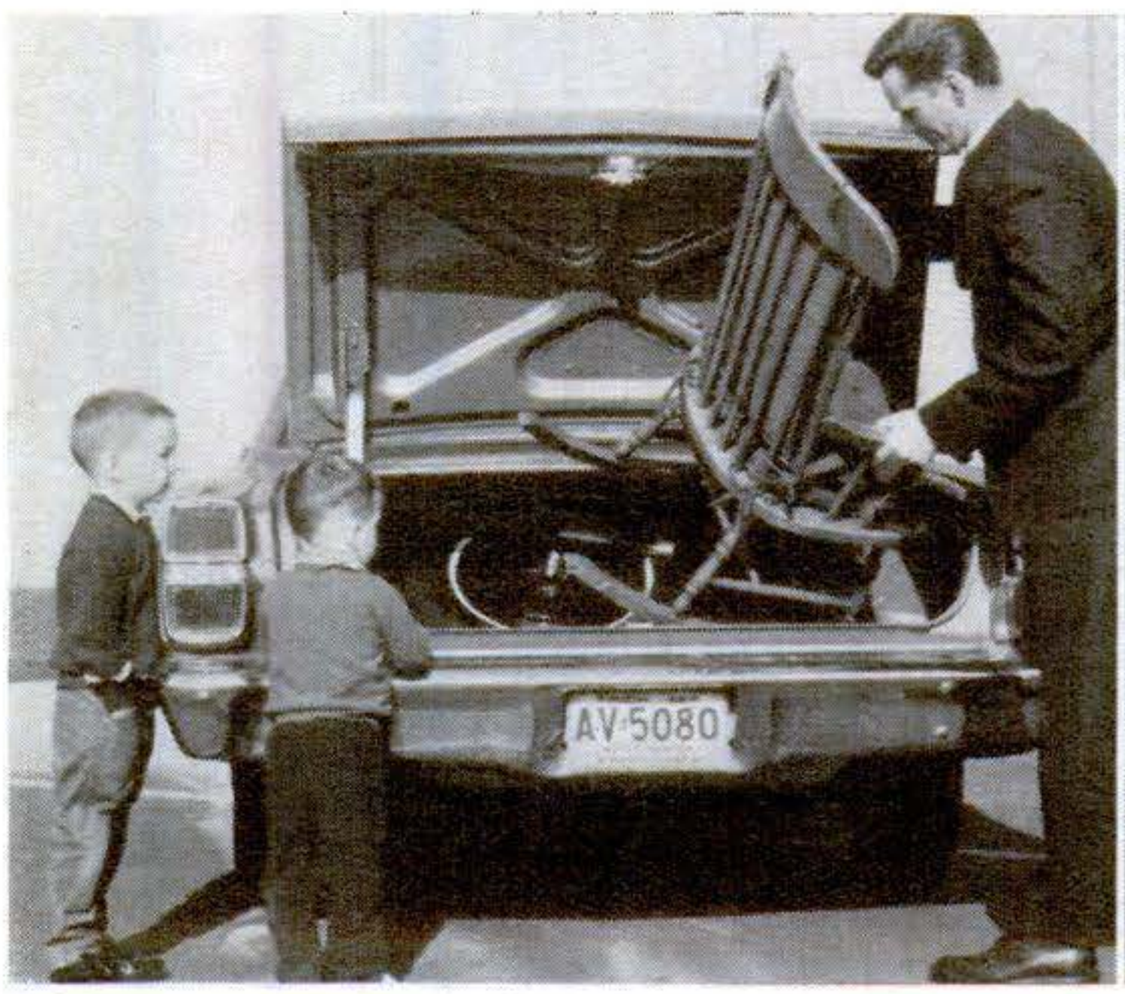
Engine noise? I found none of the cars as quiet as the standard cars. Belvedere was least noisy, although engine roar was evident in acceleration. Fairlane's engine noise is moderate and drive-train vibration is audible when the engine is laboring at low speeds. Chevelle's engine noise was similar, and the car had a transmission whine at idle. Actually, at 70 m.p.h., Chevelle's engine produces some roar, and acts more like a big six than a V-8.

In this size car, interior room is fine for people who sit in the front seat. Belvedere has excellent back-seat room, too, but Fairlane and Chevelle are no better than "good." You can't possibly wear a hat there. And while on the subject of room, I should note here that the transmission tunnels intrude boldly on front-seat leg room. Those big gearboxes were built for the standards, not these smaller cars. Step height—how high you have to step over door sills when en-

Belvedere hides spare under floor and obtains a sensibly shaped trunk. Lift-over height is 26.5 inches; the trunk lip extends 3.5 inches above the floor.



Fairlane's door-panel armrests are made of crushable material that is designed to reduce hip injuries in case of an accident. It's a good safety feature.



Fairlane trunk holds 15.2 cubic feet of useful space, but spare wheel causes problems with odd-shaped loads. Lift-over height is 26.5 inches, lip eight.

Chevelle has the biggest trunk (17.1 cubic feet) but lift-over height is 33 inches and the trunk lip is 14.5 inches. That's pretty hard on your sacroiliac.

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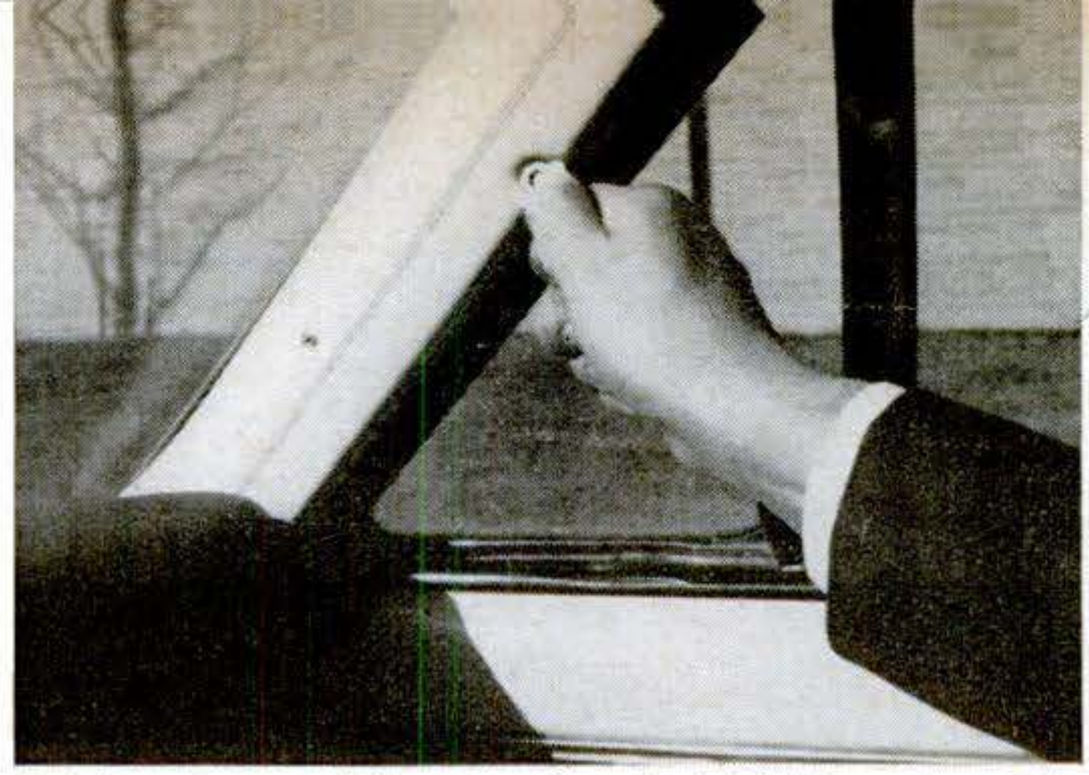
ne gives praise and finds fault

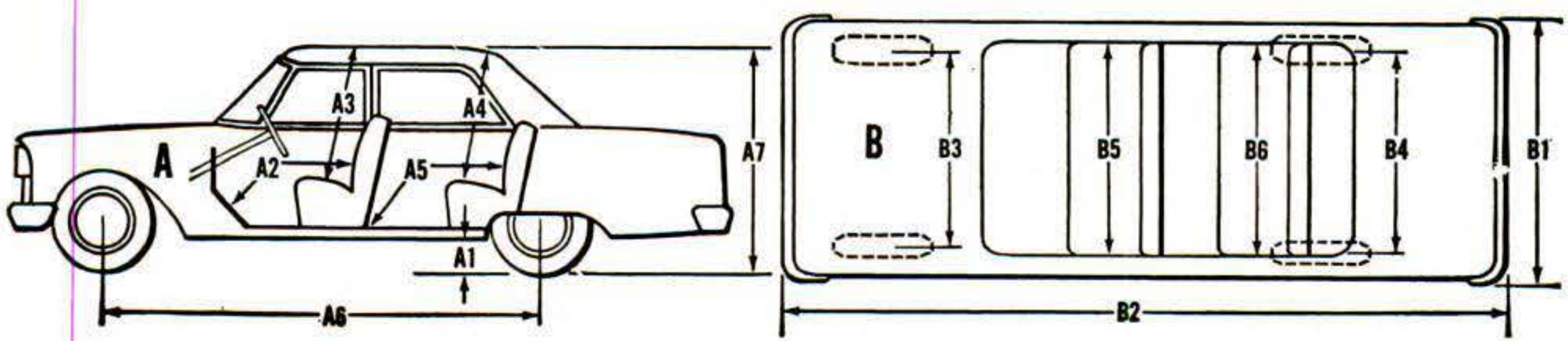
ering the cars—is slightly better on Che-velle (13 inches) than on Belvedere (16) or Fairlane (15½). All three are short on room to let you enter or leave the rear seat gracefully.

I am impressed with the body tightness of all three cars. Wind whistles are prac-ically nonexistent. In fact, only the Bel-vedere had a wind whistle, and it's not audible until you reach 40 m.p.h. Wind urbulence is moderate on all three.

Maintenance intervals differ widely, even hough each car offers a five-year, 50,000 mile warranty. You have to change oil on Belvedere every three months or 4,000 miles. Fairlane and Chevelle call for six months or 6,000 miles. Look at lubrication intervals: Chevelle says to grease their cars each six months or 6,000 miles. Bel-vedere and Fairlane merely require it every 36 months or 36,000 miles. On upkeep, Fairlane drivers have a clear advantage. PS



Fairlane has padding on the windshield posts. This adds little or nothing to the view obstruction, but all these cars have annoyingly thick A posts.



DIMENSIONS (inches)	CHEVROLET Chevelle Malibu	FORD Fairlane 500	PLYMOUTH Belvedere II
A1 Ground clearance	7.0	8.0	8.0
A2 Front leg room (max.)	41.9	42.1	42.0
A3 Front head room	38.6	38.4	37.8
A4 Rear head room	37.2	37.6	37.1
A5 Rear leg room (min.)	35.7	36.0	35.0
A6 Wheelbase	115.0	116.0	116.0
A7 Overall height	51.9	54.0	54.0
B1 Overall width	75.0	74.0	76.4
B2 Overall length	197.0	197.0	200.5
B3 Front track	58.0	58.5	59.5
B4 Rear track	58.0	58.2	58.5
B5 Front hip room	59.9	59.5	60.4
B6 Rear hip room	59.9	59.5	60.4
SPECIFICATIONS			
Engine type	OHV V-8	OHV V-8	OHV V-8
Bore & stroke	3.875 x 3.00 in.	4.00 x 2.87 in.	3.91 x 3.31 in.
Displacement	283 cu. in.	289 cu. in.	318 cu. in.
Compression ratio	9.25:1	9.3:1	9.2:1
Carburetion	Single 2-bbl.	Single 2-bbl.	Single 2-bbl.
Power @ r.p.m.	195 @ 4,800	200 @ 4,400	230 @ 4,400
Torque @ r.p.m.	285 @ 2,400	282 @ 2,400	340 @ 2,400
Transmission	Powerglide 2-speed	Cruise-O-Matic 3-speed	TorqueFlite 3-speed
Axle ratio	3.08:1	2.80:1	3.23:1
Tires	B.F. Goodrich	Firestone	Goodyear
Tire size	7.75 x 14	7.35 x 14	7.75 x 14
Steering ratio	20.4:1	21.6:1	18.8:1
Turns (lock to lock)	3.98	3.5	3.5
Turning diameter	40.3 ft.	41.45 ft.	40.6 ft.
Brakes	All drums	All drums	All drums
Brakes (swept area)	268.6 sq. in.	251.4 sq. in.	267.0 sq. in.
Curb weight	3,288 lb.	3,259 lb.	3,422 lb.
Basic price	$2,540	$2,545	$2,528
Price as tested	$3,133	$3,041	$2,953

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Dogsled racing offers one of the wildest rides possible. In the photo above, driver Herb Wall urges his team off to a flying start in a race at Barrie, Ontario, witl dogs Sitka and Kutchum at the fore. Racing p

DOGSLED DERBY: Hills

By ROBERT GANNON and E. D. FALES, JR.

One day late this month, 25,000 people will tramp through snow at Laconia, N.H., to watch scores of hard-driven dogsleds go whistling through town, down forest trails, across a frozen lake. The racers will be fighting it out in a tough 60-mile, three-day grind for $5,600 in prizes.

About the same time, at Saratoga, N.Y., Petoskey, Mich., Mt. Hood, Wash., and Park City, Utah, other thousands will gather for similar big races. So will they in Fairbanks, Anchorage, and Tok Junction, Alaska, and in Arizona, Oregon, and Canada.

For dogsled racing, one of the world's toughest sports, is enjoying a boom that may elevate it—at least in the Northern states—to a big winter pastime.

Though dogsled races were being held in New England as far back as 1922, 10 years ago the sport was dead. A good many dogs and "mushers" had gone into World War II and failed to return. There were scarcely a dozen sleds in the country. But today, from California and Arizona to Maine and Massachusetts, there are some three dozen thriving clubs, one of which boasts 2,800 members.

Best drivers and teams come from New England right now. Since 1958, New England entries have won every major race, even those in Alaska—"which is pretty hard for Alaska to take," says Barbara Hubbard of the New England Sled Dog Club. "I think we take our racing more seriously," she says, "and our dogs are kept in better condition—better than a lot of kids are, so far as nutrition is concerned." The club has 120 racing teams among its members.

Dogsledding is time-racing over snowy courses from one to 60 miles long, often through woods trails, along back roads, and across frozen lakes. You may team up with another man in the ownership of the dogs, but you'll never team up in a race. You race alone. You never sit down; you stand on the runners, and you work as hard as your dogs.

You'll need at least one lightweight racing sled. These neat assemblies, usually

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Wind whistles as dogs and sleds race over rough terrain. Read about the rebirth of the toughest winter sport

ls claim that it's easier to train sled dogs ll than it is to train the drivers.

Racing, dead 10 years ago, is now growing in popularity with a number of events each year in the Northern states.

hills, Spills, Thrills

about seven feet long and weighing less than 30 pounds (freight sleds weigh up to 200 pounds) can be built in three or four Saturdays. Top sled maker, say the pros, is Ed Moody of Rochester, N.H., who charges about $175 for a racer.

Ash, rawhide, and steel. Sleds usually are made of one-by-1½-inch ash poles treated in a home steamer (a water-filled pipe running at an angle through an oil drum in which a fire is burning), then lashed together with rawhide. The runners, 20 or 22 inches apart, are sheathed with stainless steel or aluminum.

A team can be anywhere from one to 17 dogs. One dog can haul a child on a half-size junior sled, but two or three are better. Adults use five dogs or more. Many settle for seven, since bigger teams take more managing and, of course, cost more to

Continued

Teams are hauled to races in "Pullman" trailers with a small room for each dog.

Sled dogs are trained to wear harnesses like this one. They may be purchased or made by the owner from nylon or leather.

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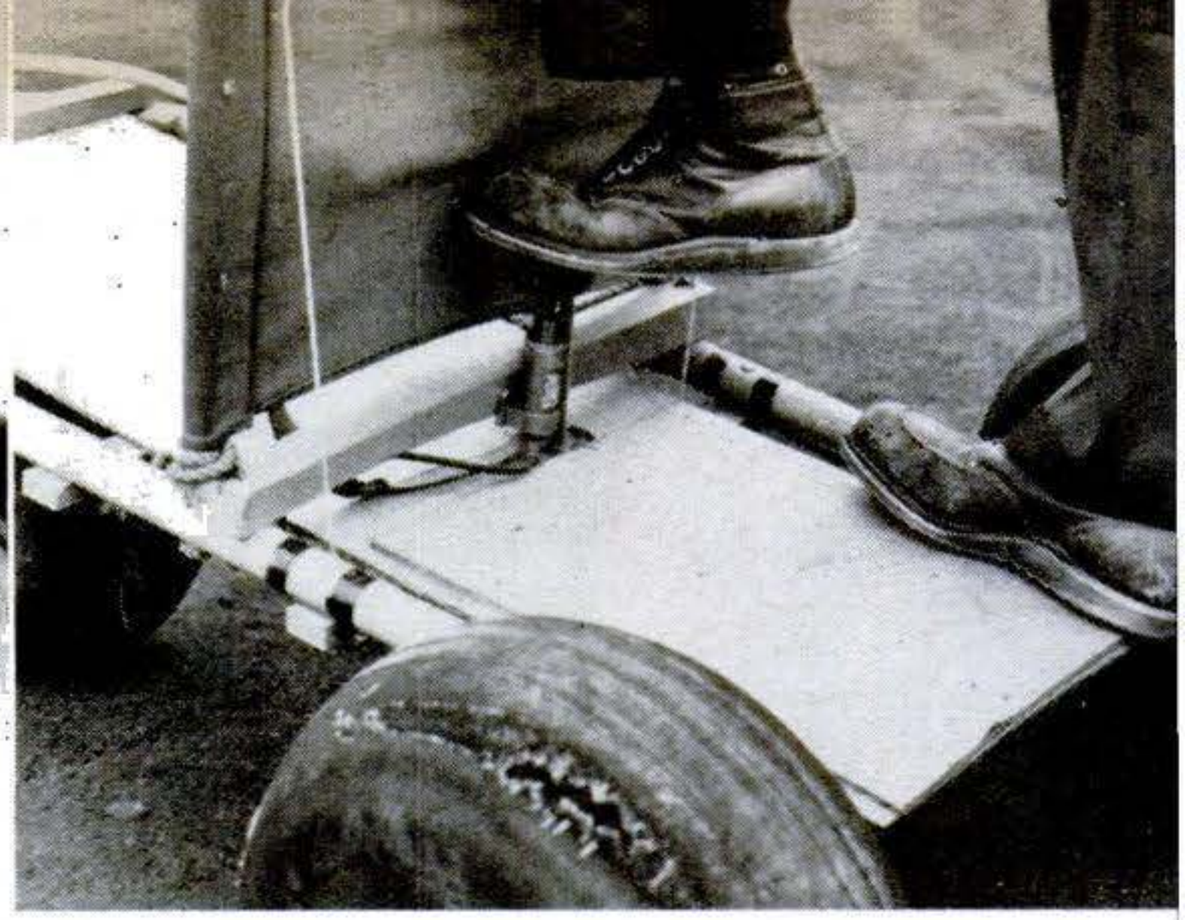
Brake—a steel claw attached to a wooden strip—is used to slow sled from up to 25-m.p.h. speed.



Summer training? Sure, but with wheeled vehicles equipped with pneumatic tires and hydraulic brakes.

"Hi, hi!" you urge, and the dogs are off in a cloud of snow. Yo

feed. A dog will eat two pounds of food a day during the racing season. As musher Dale Trippe of Tamworth, N.H., says, "It's a rich man's hobby with mostly poor people involved." But most drivers sell enough puppies to pay the food bill.

The majority of racers use one of the four broad-footed Arctic sled dogs: 70-pound Alaskan Malamutes, ideal for endurance runs and tough terrain; Siberian huskies, small and fast (often with one blue eye); the white Samoyed, another tough Siberian breed; and the powerful Eskimo dogs, used mostly in the far north to pull heavy loads.

But you may see other dogs as well—a coon hound, for instance, in the midst of a team; the baying, so drivers say, spurs on the others. One Quebec driver used to employ a border collie as his lead dog for 10 Siberian huskies. Don Blodgett of Hollowell, Me., has an 11-dog team of full-blooded Walker hounds. (He also uses them for hunting.) Another racer uses Irish Setters, a third, pointers. There once was even a team of St. Bernards and standard poodles.

Training dogs and drivers. Training a dog to race is easy, if you have a going team. It's a matter of example. You just pull off one of your experienced dogs and snap the trainee in his place. "A dog inherits the tendency to pull," says short, peppery Eva Seeley, of Wonalancet, N.H., owner of Chinook Kennels, 44-year-old cradle of U. S. sled-dog activities. (It was here Admiral Byrd's teams were trained.)

The dogs quickly learn commands, and each driver has his own. To get a team going he usually just hollers; it's the sound of the voice, not the word, that jolts the dogs into action—though if pressed, drivers will tell you they say "Hike," or "Let's go!" or "Scat!"—anything, it seems, but "Mush!" "Whoa" or "Hold on" means stop, while "Gee" means turn right; "Haw," left.

The summer is too hot for a far-North dog to do much but pant. But in the fall, drivers condition their teams on gigs, cars stripped down to their chassis. "Five months a year the dogs work for us," says Siberian-husky kennel owner Stuart Mace of Aspen, Colo. "The rest of the year we work for them."

Going to a race. Most dogs are hauled to races in trailers, in which each has a small, ventilated room.

At the starting point, teams are "anchored out" to tethering lines stretched between trees. Each dog is slid into his harness (usually homemade, they can be bought for $3 to $5), then snapped to a long nylon rope called a tow or tug. (Gear consisting of rings, snaps, and rope costs around $18.) The best dog in each team, the lead, runs alone. Behind him are his working crew—two swing dogs, then pairs of points, and nearest the sled, wheel dogs.

Let's say you're to be No. 3 sled out. As you move to the line under a strand of pines you'll see the long snow trail leading into the distance. Let's suppose this is a 10-mile race. You hold your team, standing by the leader; or, if you have trained the dogs exceptionally well, you may let them approach the starting line slowly while you walk behind your sled.

On your mark. Teams usually leave at three-minute intervals. "Go!" an official shouts to the No. 1 sled, and glances at

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Dogs used for racing range all the way from the white Samoyed, a Siberian breed, to Eskimo dogs, Alaskan Malamutes, and even hounds, setters, collies. Here sandy beach allows summer workout.

eed hits 18, 20, higher, with your feet inches off the ground

his stopwatch. The dogs are off in a cloud of snow. Three minutes later No. 2 team goes. Then it's your turn.

Your leader toes the line, anxious. You hunch behind, feet braced on the runners. "Ready." The dogs understand. Some crouch and whine; others bark excitedly and start forward. "Whoa!" you shout. "Hold it steady."

"Go!" you holler at the dogs, and crouch hard to keep from being snapped off the sled. Your eager team suddenly lurches forward in a cacophony of barking.

The ice crunches under your runners, tickling your feet, as your speed jumps to 10, then 12 m.p.h.—and that's fast when your shoes are only an inch off the ground.

"Hi, hi!" you urge, for more speed. The other sleds are out of sight ahead. The dogs are running low, pulling hard, yipping and barking. Your speed hits 15, then 18. You're streaking down the narrow track, runners whistling. You take a fast turn downhill through low trees, under bushes. A low branch flies toward you; there's a crashing sound as your brush guard, a sturdy bowed rod on the sled, knocks it away from your face.

You're going 20 now. Your sled rocks like a skiff in a gale. Your hat flies off; you let it go. Breathless, you find yourself laughing, while wind-whipped tears roll into your ears. But there's no one to see or hear. You're deep in the woods, counting on that lead dog 75 feet out in front.

The sled whiplashes, and you balance yourself like a skier. You brace your feet, hold on hard, kick off ice lumps. Your ears get cold as the wind skitters into your parka hood. The dogs kick snow in your face. Then comes a really sharp curve.

You're into it well above 20 m.p.h.—much too fast. At this speed your sled may tip over. You drag your foot sideways. Still too fast. So you jump on the brake strap, a board with an iron claw (perhaps from a garden rake). It digs in, slows you. But not enough. It will be a dangerous turn. Bouncing like a belly dancer to keep balance, you throw all your weight on one runner and twist the sled into the turn.

The dogs bank. You fall off, but hang on with one hand dragging in the snow. Then you're around. You haul yourself back on the runners, and streak past rock, over a pond, toward a mountain notch.

Joining the team. Now there's a long climb. You "pedal" awhile, pushing as though on a scooter, and then you get off and run, steering as well as you can. Your team slows; you try to run ahead, but in the deep snow your legs want to quit. You struggle up, grab the tow rope and start to haul with the dogs, as they break into new, cheerful barking, welcoming your help. You're part of the team now.

Over the top, and soon you're through the notch, whistling across a meadow in a whirl of snow. You look ahead; far across the fields are the first two sleds, far behind, the others, coming fast. You've at least kept your position—in fact, you've gained, and you'll find later that you've averaged 14 m.p.h., excellent for the snow texture.

Your runners sing shrilly as you whirl across the finish line. Then you call a stop, and drop flat on your back into a snowbank, exhausted, but grinning like a half-wit. PS

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Novel hand grips, "golden slippers," and ring-anchored harnesses come to the aid of astronauts riding the outside of their orbiting craft like human flies

New Ideas Solve the Weird Problems of SPACE WALKING

By DR. WERNHER VON BRAUN

Director of NASA's George C. Marshall Space Flight Center, Huntsville, Ala.

When astronaut Edwin E. Aldrin Jr. breezed through a more-than-two-hour program of manual tasks outside his Gemini 12 spacecraft, in the final Gemini flight last November, he showed the feasibility of assigning practical jobs to "space walkers." His success, made possible by ingenious new aids, allayed serious doubts about the capabilities of "human-fly" astronauts that earlier trials had raised.

Space walking—or EVA, for extra-vehicular activity, as it is called in official NASA lingo—has been from the very beginning one of the major objectives of our manned space program. Its importance is obvious. Assembling large space stations and vehicles in orbit, and many other future tasks of astronauts, will depend greatly on their ability to do things outside their spacecraft. This is the reason behind U.S. space-walking trials, begun in our Gemini flights and expected to be continued in our current Apollo series.

The first American EVA came in 1965 when astronaut Edward H. White II left his Gemini 4 for 22 minutes and demonstrated that, with a simple hand-held gun squirting out oxygen gas, he could stabilize himself in space and move around in any direction he wanted.

Then troubles began. It now seems that White's flawless performance led to some unwarranted overconfidence about EVA. For when Eugene A. Cernan tried to strap himself to a more sophisticated "astronaut-maneuvering unit" (AMU), a backpack carried aloft outside the *Gemini* 9 capsule, he became so exhausted and overheated that his environmental-control system failed. Winded and unable to see through his fogged visor, he had to abandon the AMU experiment and return.

Subsequent EVA with Gemini 10 and 11, by Michael Collins and Richard Gordon respectively, confirmed that Cernan's experience was no isolated case but, rather, indicative of a serious and basic problem. Collins had extreme difficulty in getting a handhold on the Agena target vehicle to which his Gemini 10 was docked, and lost a camera in struggling to reach the Agena.

Gordon succeeded during his EVA in tethering Gemini 11 by a 100-foot line to an Agena. (This permitted the first artificial-gravity experiment in space, by rotating the tethered vehicles around their common center of gravity, as told in my Nov. '66 article.) Nevertheless, he became badly exhausted.

Worked like a horse. The medical rec-

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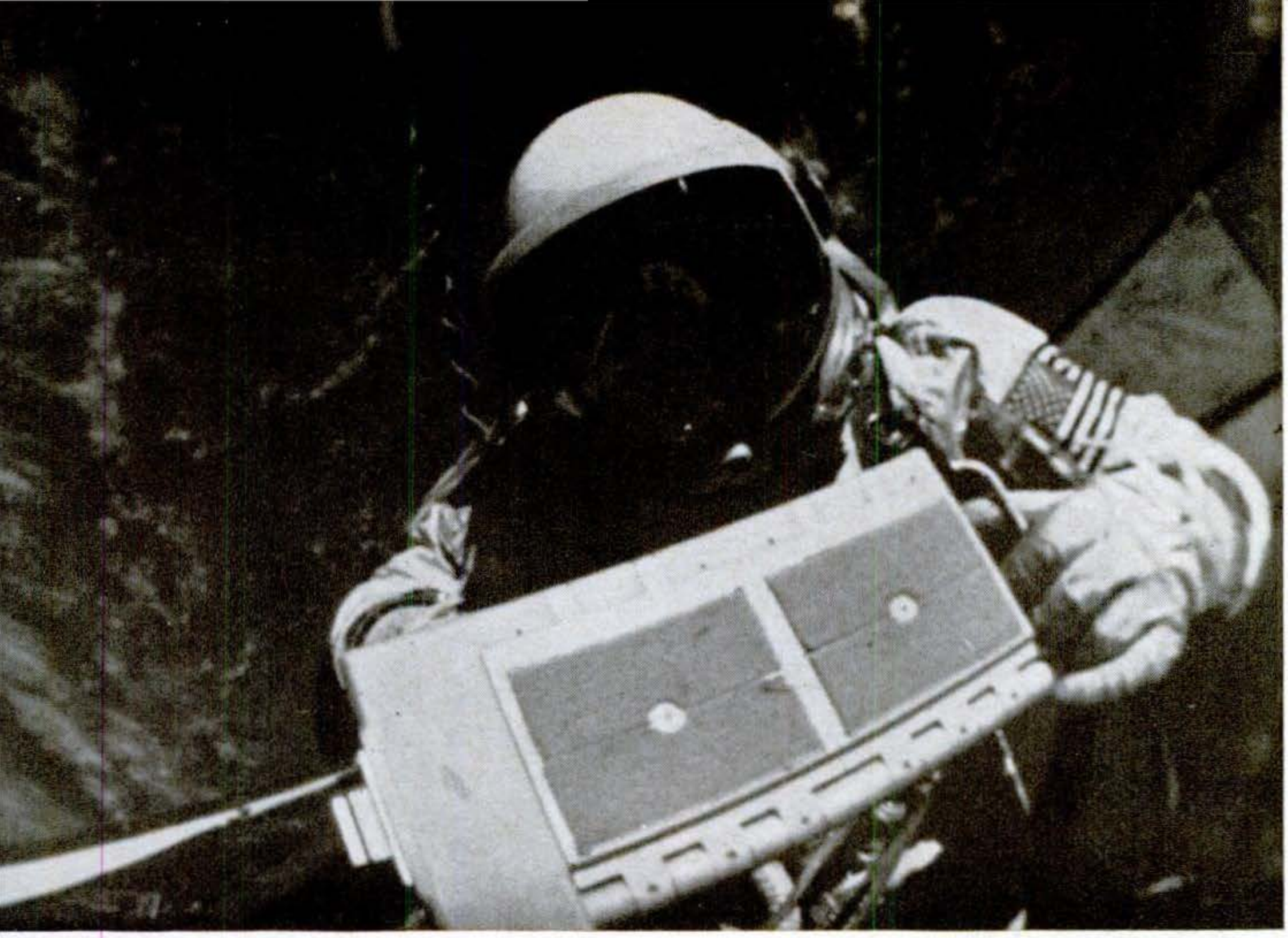


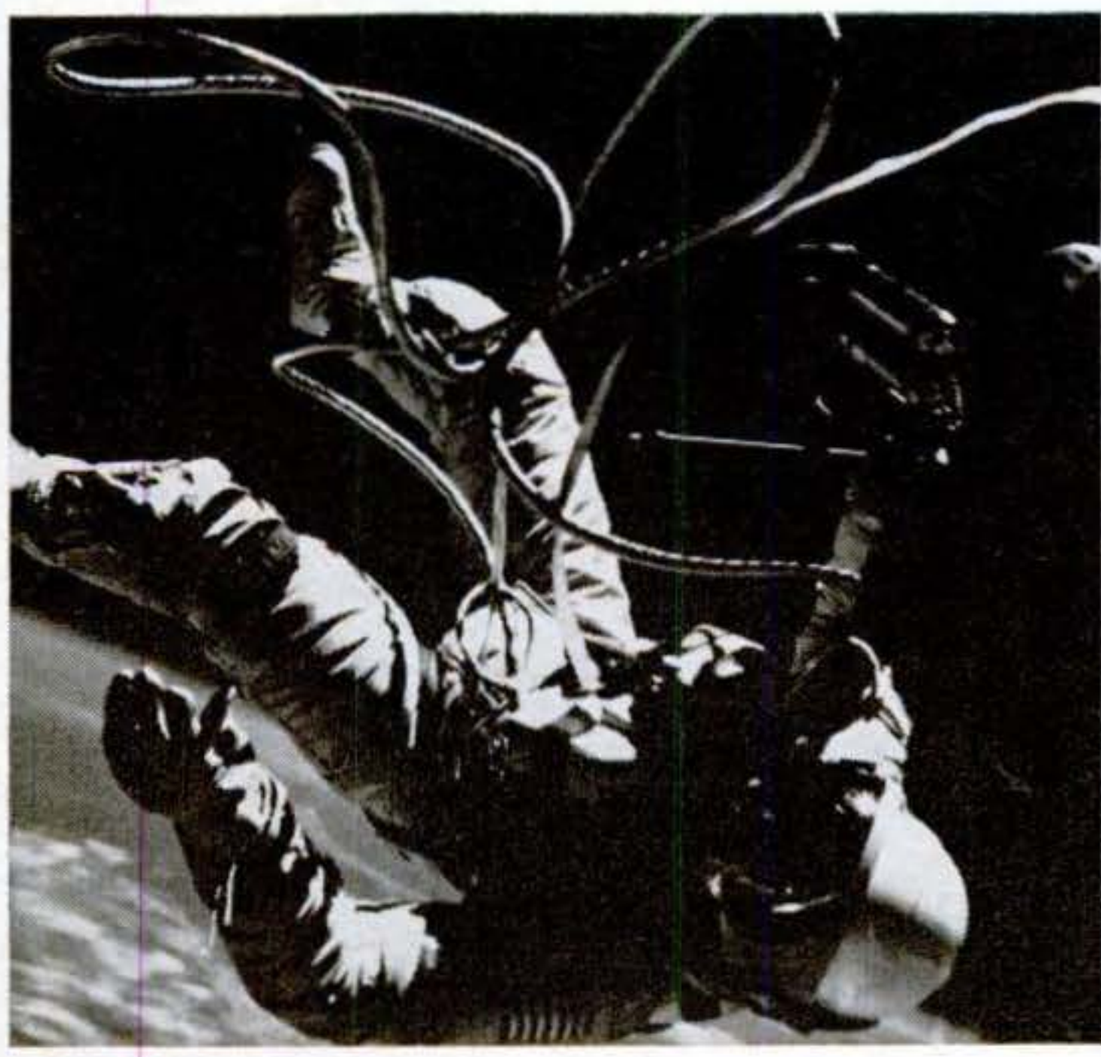
Gemini 12 space walker, "Buzz" Aldrin, retrieves micrometeoroid package carried outside craft.

ords later showed that Gordon's strenuous efforts generated heat at the extraordinary rate of more than 3,000 BTU per hour, which exceeds one horsepower! Commented Dr. Robert R. Gilruth, Director of the Manned Spacecraft Center in Houston:

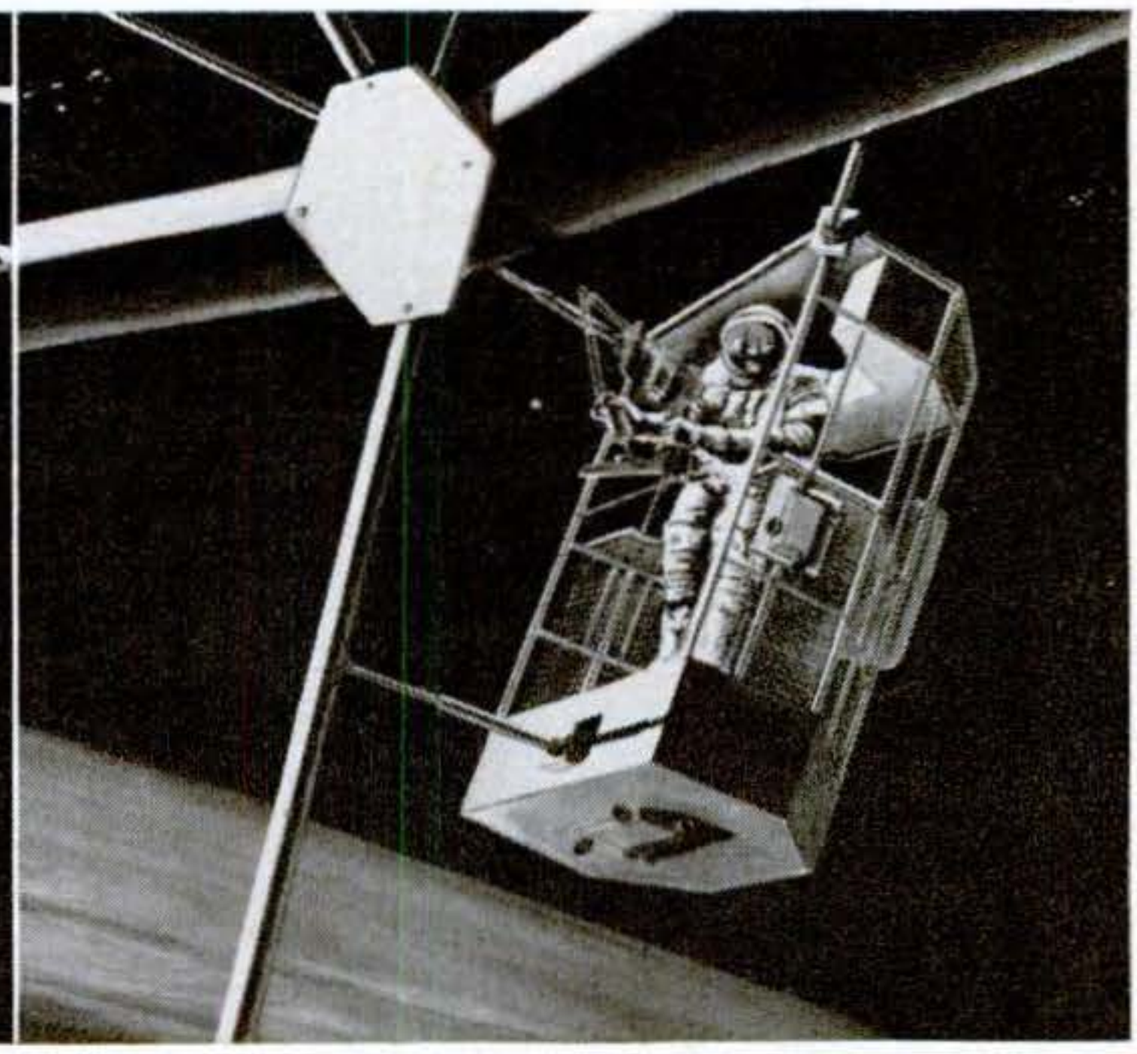
"We are not dealing with horses. It is not reasonable to ask nor expect a man to work at this level in space."

What was the problem, and how was it solved? Zero gravity itself could not be blamed—astronauts had spent two weightless weeks in space without tiring. Was

[Continued on page 204]



First U.S. space walker, Edward H. White II, successfully maneuvered himself on 23-foot lifeline outside Gemini 4 with hand-held gas gun. Problems of doing practical tasks awaited his successors.



Future space walkers may use aids like this "maneuverable work platform," which could be directed and attached to part of structure being worked on, to assemble large stations and vehicles in orbit.

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Here's another opportunity to

POPULAR SCIENCE

1st PRIZE: Your choice of a Mustang, Camaro, Barracuda, o

2nd PRIZE

A deluxe 25-inch, rectangular, Heathkit color TV you can build

150 3rd PRIZES

New Schick Traveler electric razors, with a handsome travel pack

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vin one of these cars in new

SPOT-THE-CARS GAME

How expert a car spotter are you? Turn the page!

Pictured on the following pages, partially hidden by Mystery Spots, are six 1967 popular-make cars you see in your town and on the highways every day. Identify four of the six shown —and you may be the winner of a brand-new car and 1,000 gallons of gasoline, or one of the other valuable prizes. For helpful tips, check the clue list that follows, or visit your local car dealers for a close-up look at the actual cars. ►►►

ambler Rebel SST—and gasoline (1,000 gallons) to run it

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Identify four or more of these cars and you may be a winner in Popular Science's Spot-the-Cars Game . . . Enter today!

OFFICIAL RULES for the PS Spot-the-Cars Game:

1. On the official entry blank—or on plain paper—identify four of the six cars you see pictured above; then print your name and address. No purchase is required. The issue of POPULAR SCIENCE may be consulted in libraries and reading rooms. Additional entry blanks can be obtained by mailing a request to Box 334, Collingswood, N. J. 08108.

2. You may enter as often as you wish; each entry must be mailed in a separate envelope.

3. Mail your entry to Spot-the-Cars, Box 333, Collingswood, N. J. 08108. Entries must be postmarked no later than March 15, 1967, and received no later than midnight March 25, 1967.

4. Winners will be selected in a random drawing from among all correct entries by Reiter-Ross Premium & Contest Division, Inc., an independent judging firm whose decision will be final. Only one prize to a family. Winners will be notified by mail within 30 days after the close of the contest.

5. All U.S. residents may enter the Spot-the-Cars Game, except employees (and their families) of POPULAR SCIENCE, Reiter-Ross and/or its advertising agency, or where prohibited by state or local laws or regulations. Taxes on prizes are responsibility of winners. No substitutions for prizes will be allowed.

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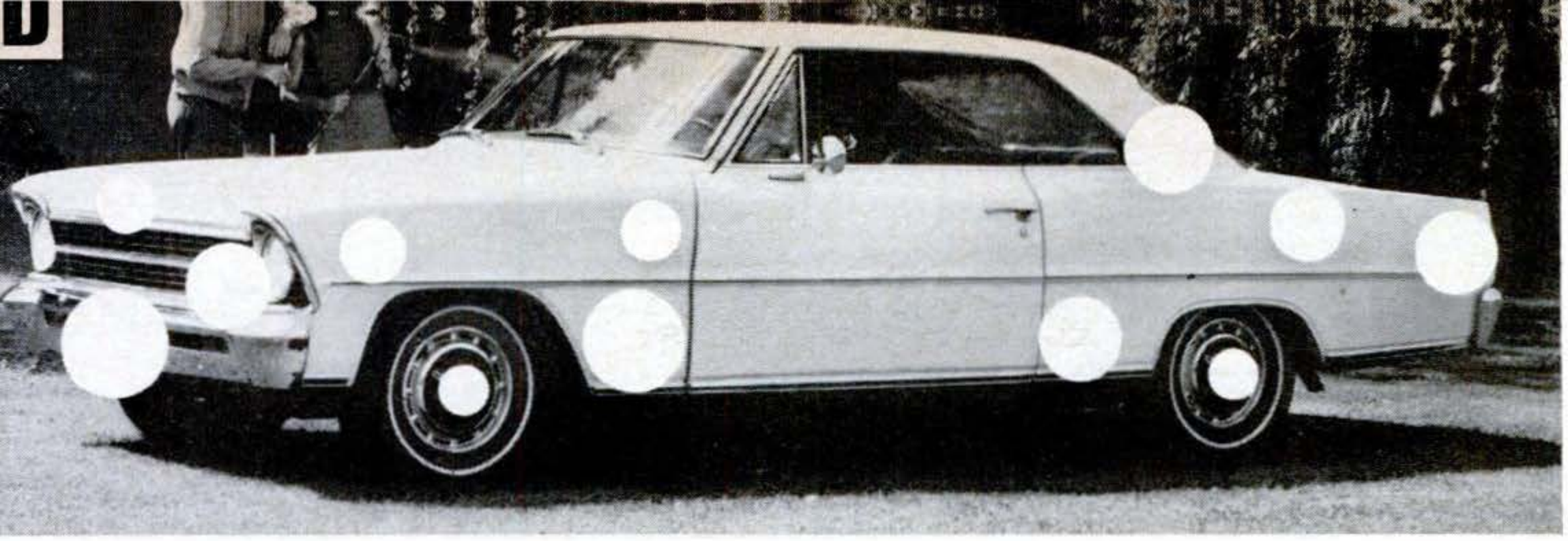

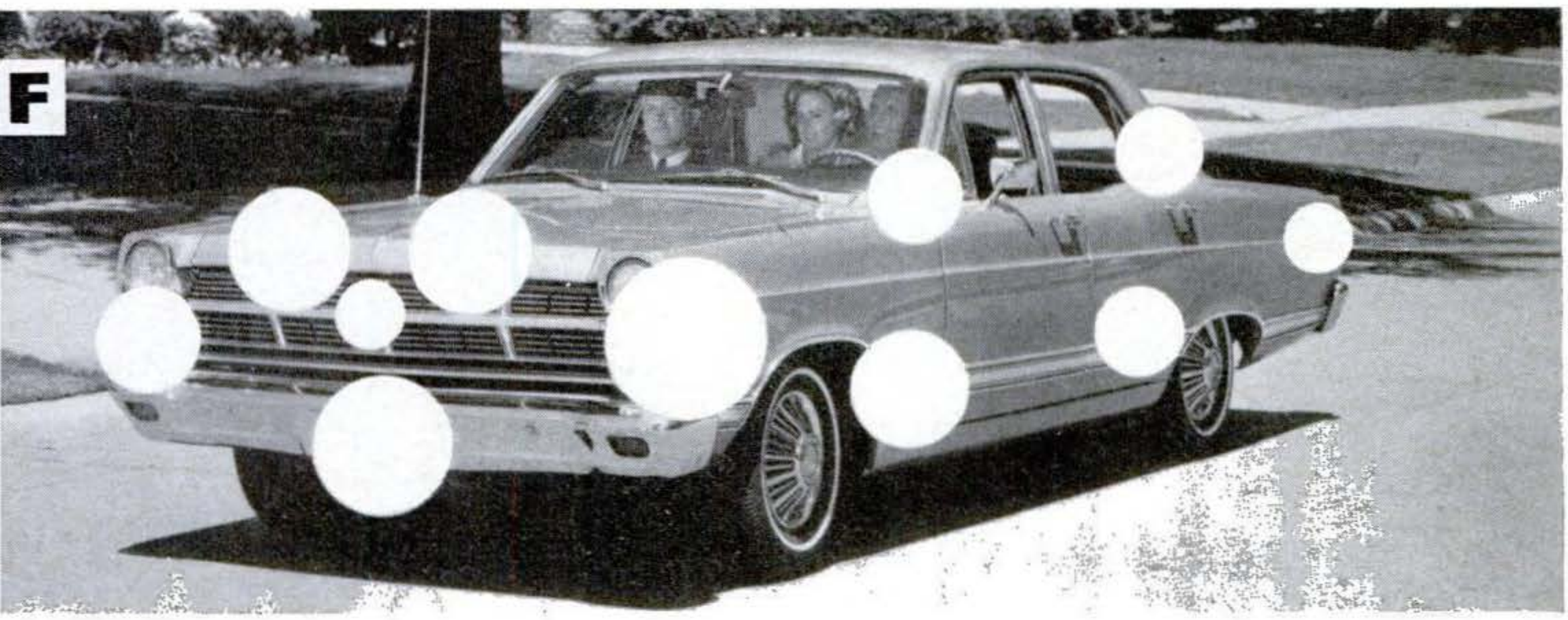

The correct names of the mystery cars are in this list:

Pontiac GTO
Mercury Cougar
Dodge Dart GT
Lincoln Continental
Rambler Rogue
Buick Skylark
Chevy II Nova
Ford Fairlane
Ambassador 990
Plymouth Valiant
Pontiac Le Mans
Chevrolet Chevelle

NO PURCHASE REQUIRED TO ENTER

Spot-the-Cars Game, Box 333, Collingswood, N. J. 08108

The cars are: (Please Print)

(A) _____ **(D)** _____

(B) _____ **(E)** _____

(C) _____ **(F)** _____

NAME _____

STREET _____

CITY _____ STATE _____ ZIP CODE _____

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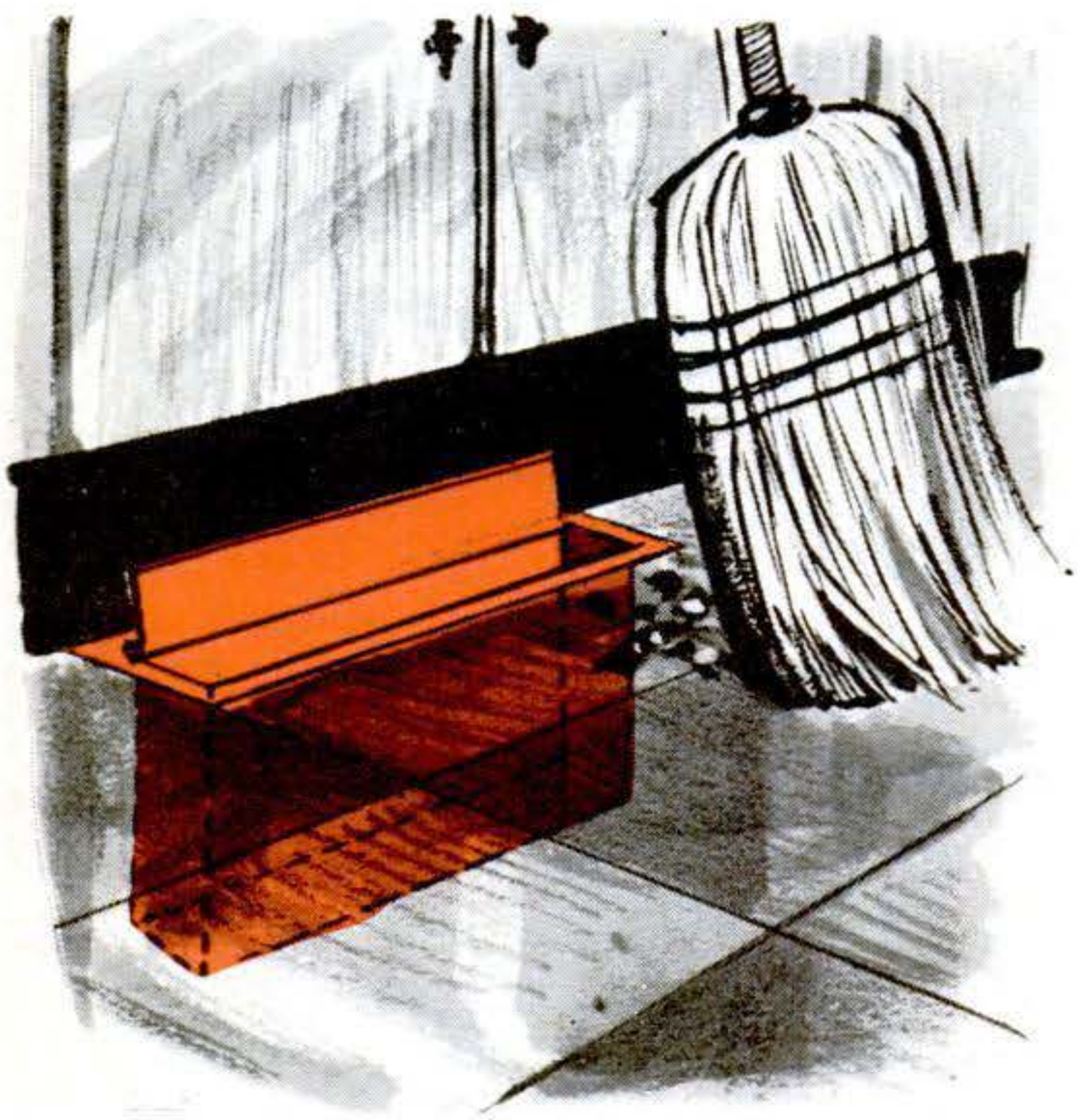
New Ideas from the Inventors

DRAWINGS BY WILLIAM CASTIMORE

Brakes snug seat harness. A safety harness worn tight enough to protect you in an emergency may be too tight for normal driving comfort. Seat-back reels in this recent patent, however, would take up any slack when you stepped heavily on the brakes. You'd adjust the straps against biased springs in the reels. A hydraulic piston—triggered by brake pressure or by a sudden forward pull—would wind the straps, taking up slack to restrain your movement.



Recessed bin collects sweepings. Set into the floor of a kitchen or other room, this flanged metal receptacle would simplify clean-up and eliminate the filling—and emptying—of dustpans. The unit could be installed in any out-of-the-way corner. The hinged lid (which could be finished to match the floor covering) would tip up to receive sweepings. The whole unit would lift out of its slot for emptying.

Newspaper holder forms umbrella. You wouldn't be caught unprotected by sudden rains if you kept a plastic fold-up frame like this in your pocket, car, or on the job. Unfolded, it would form a holder for a spread-out newspaper, let you draw the paper over your head like a tent. Curved slots in three of the five pivoting links would grip the edges of the newspaper. The unit would fold to under seven inches.

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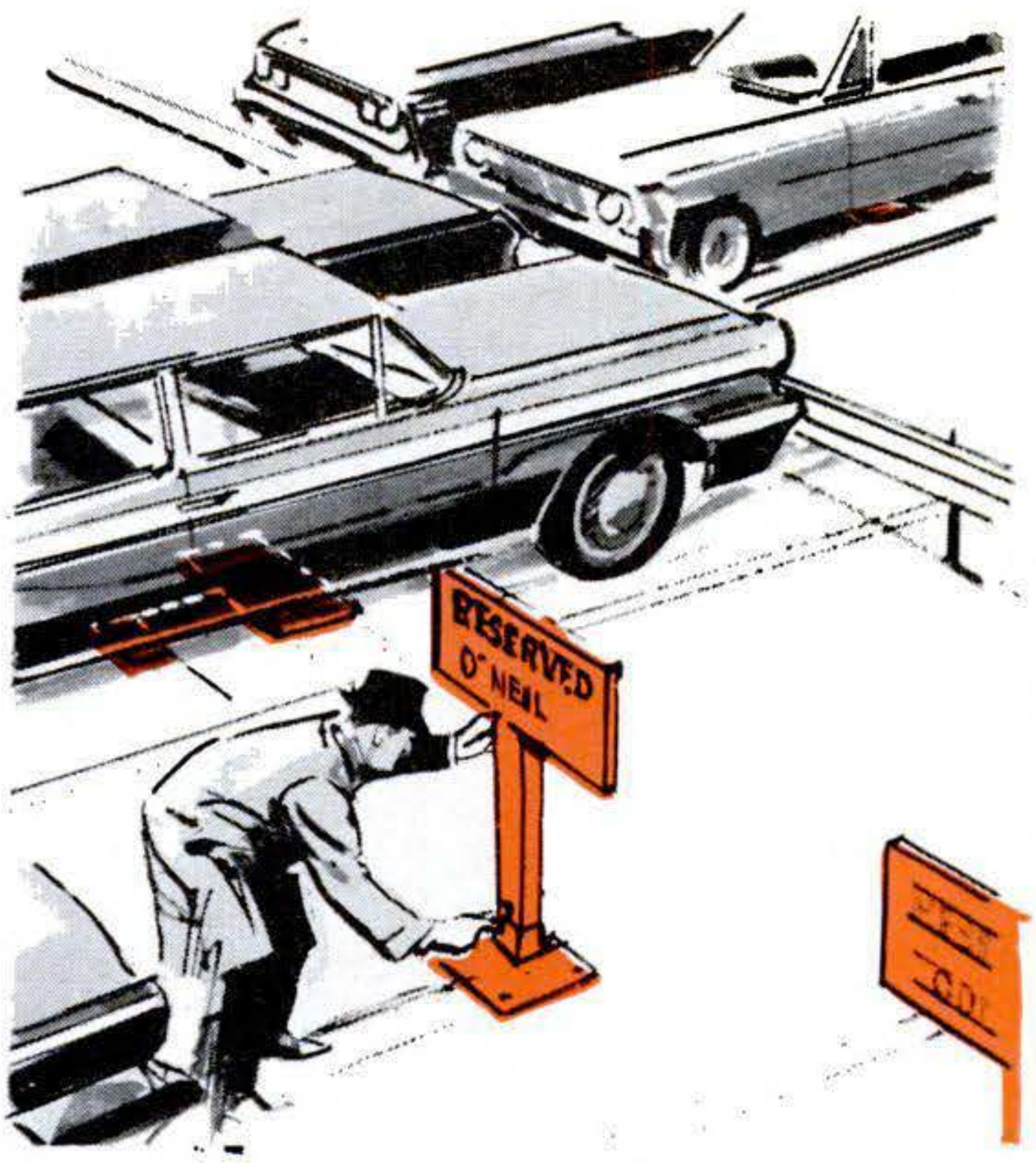
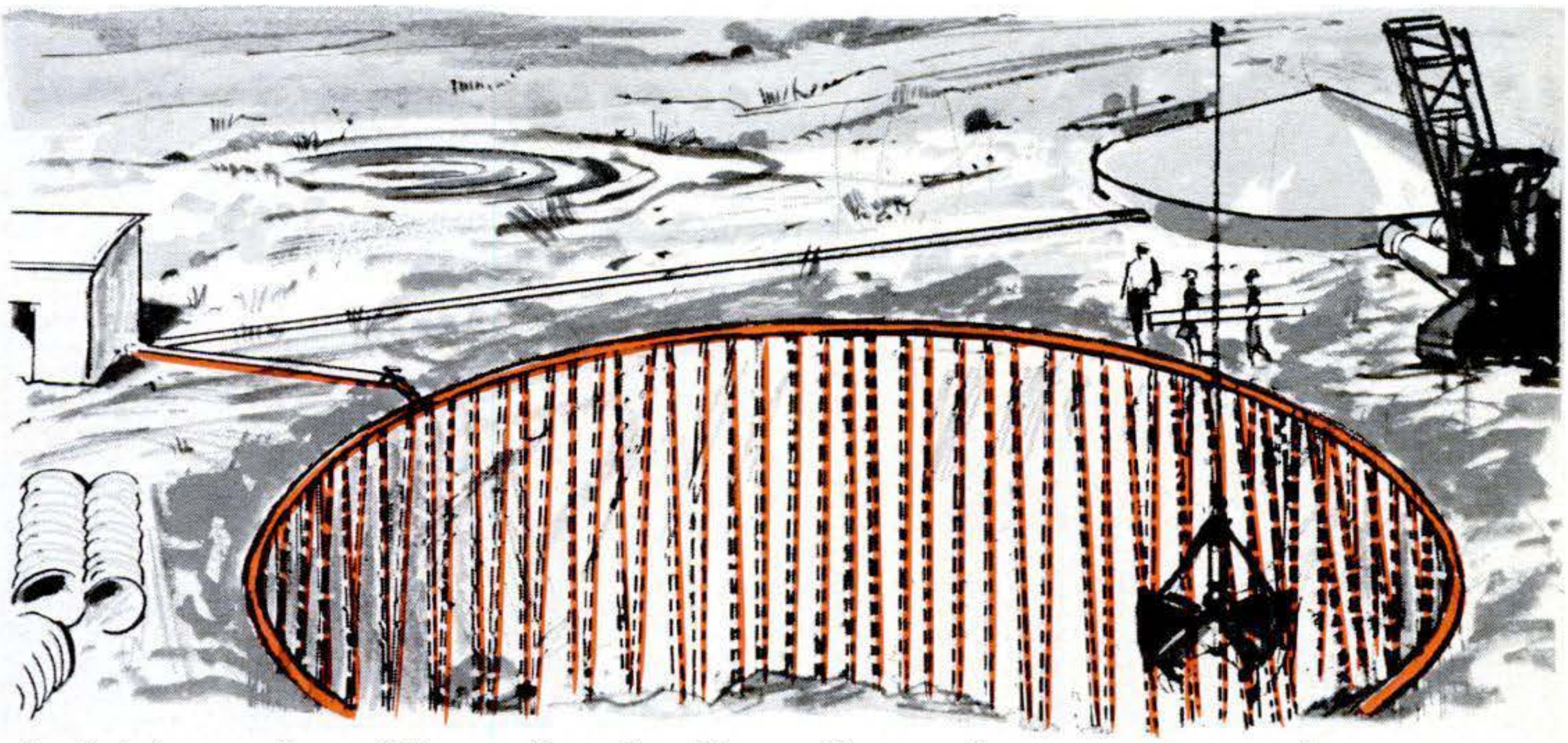


Barrier reserves parking space. Signs often can't be counted on to reserve parking spaces in unattended lots, but a lock-out barrier like this should do the job. In upright position, the stanchion would effectively block a parking slot. The assigned user, however, could unlock the barrier, lower it, and drive his car right over the let-down sign into his reserved space.

Hammer magnet picks up nails. A slightly rounded magnet slipped over (or set into) the base of a hammer handle would make it easy to pick nails out of a box or apron pocket. The rounded magnet would usually spread the nails for easy selection, keep them near the work, hold the extras firmly even during hammering, and leave one hand free to hold a started nail.



Angled freeze pipes stiffen earth walls. Vertical piping is used today to force refrigerant into soft ground to harden walls around an excavation to simplify construction, prevent settling, or form a permanent, low-cost storage tank. This inventor claims that alternating straight and angled pipes would reduce the number of pipes and the refrigerant needed.

The following patents have been issued on these inventions: **Harness reel**—*No. 3,220,747 to F. Marion, Scottsdale, Ariz.,* **Recessed dustbin**—*No. D 203,888 to D. Hultquist and D. Franzen, Bloomington, Minn.;* **Umbrella frame**—*No. 3,280,830 to J. Zweben, Bellmore, N.Y.;* **Parking barrier**—*No. 3,235,214 to A. Sprung, NYC;* **Hammer magnet**—*No. 3,228,720 to D. Jordan, Pleasantville, Iowa;* **Freeze pipes**—*No. 3,267,680 to E. Schlumberger, London, England.*

Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington, D.C. 20231, at 50 cents each; D (Design) patents are 20 cents. To write to an inventor, address him (by name and patent number) in care of the Commissioner of Patents.

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GADGETS TO IMPROVE TV:

RABBIT-EARS ANTENNA
COLOR-TONE FILTER
RCA INDOOR ANTENNA
SPRAY CONTACT CLEANER
LIGHTNING ARRESTER
WALL-MOUNT ANTENNA
SPEAKER KILLER
LINE-CORD ANTENNA
SCREW-ON INTERFERENCE SUPPRESSORS
PLUG-IN LINE FILTER
MARKS 3-D GLASSES
PICTURE-TUBE BRIGHTENER
PLUG-IN SURGE LIMITER

We tested this imposing array of gadgets pictured above on black-and-white and color TVs.

The spray cleaner's instructions say you should insert the injector nozzle in "any opening in tuner or control" and press the button. The ejected solvent—in theory—settles on the contact surfaces; you clean them by working the tuner back and forth.

Marks 3-D glasses do impart a slight three-dimensional effect to TV viewing, and, in spite of their colored lenses, don't ruin TV colors. The maker claims that you can also wear them to the movies. No one testing them complained of headaches.

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Are They Any Good?

To find out, we tested a shelf full of gadgets one at a time. Here's what we learned

By **RONALD M. BENREY** / *PS Electronics Editor*

You can buy them almost everywhere—in appliance stores, five-and-dimes, drug and department stores, and even supermarkets. And you can order them by mail—through scores of promise-laden advertisements in newspapers, magazines, and electronic supply-house catalogues.

But are these gadgets that claim to improve the TV picture you see really worth buying? To find out, POPULAR SCIENCE purchased the carton-load of popular TV gadgets shown at left.

We followed the instructions packed with each device, and installed it—or used it with—one or more of our test TV sets.

Several of the gadgets were billed as interference eliminators. To test them, we duplicated the most common forms of radiated and power-line interference with a five-watt CB radio transceiver, a hand-held grinding tool, and an SCR-type light-dimmer.

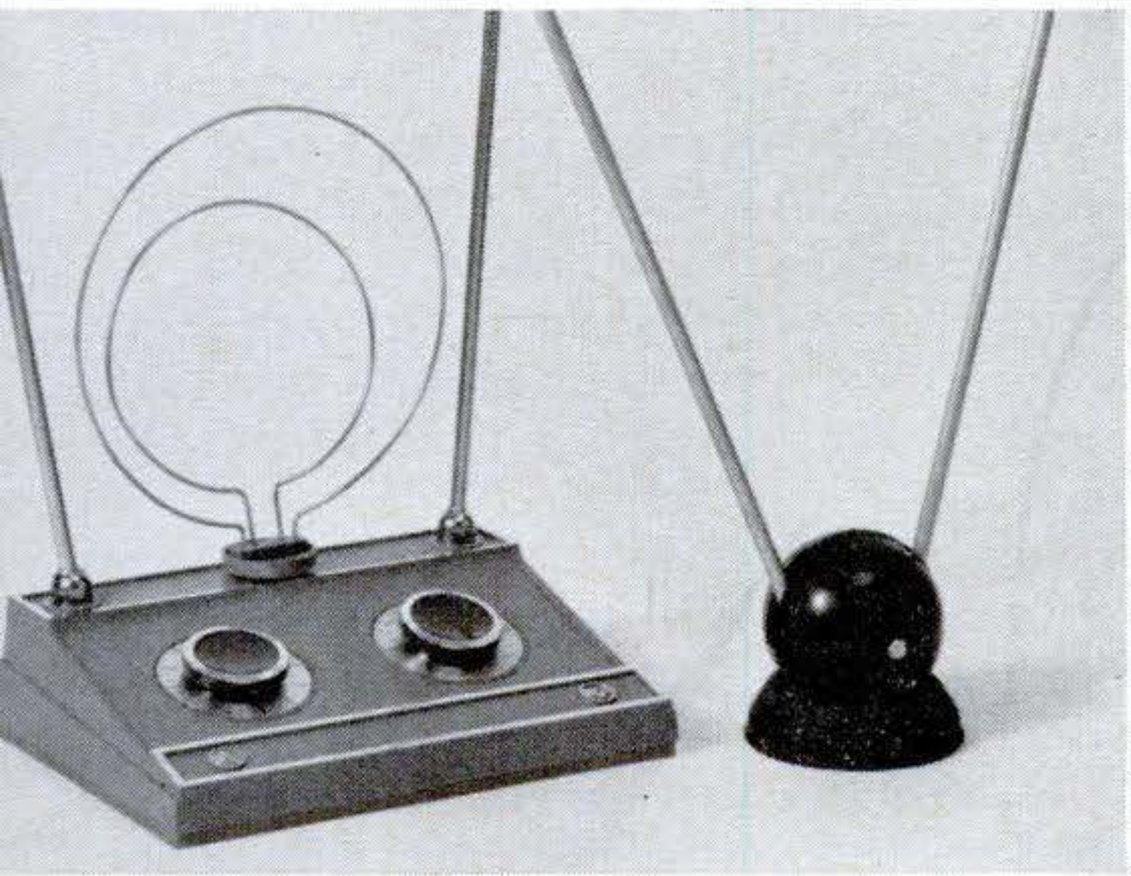
A few of the devices were unusual indoor antennas. We used a professional signal-strength meter to gauge their effectiveness. Here's what we learned:

Spray contact cleaner. This is a non-flammable organic solvent packed in an aerosol spray can. The solvent is formulated to remove dirt from switch contacts in TV tuners, and from metal wipers in volume controls. Several types are on the market costing between $1 and $2.

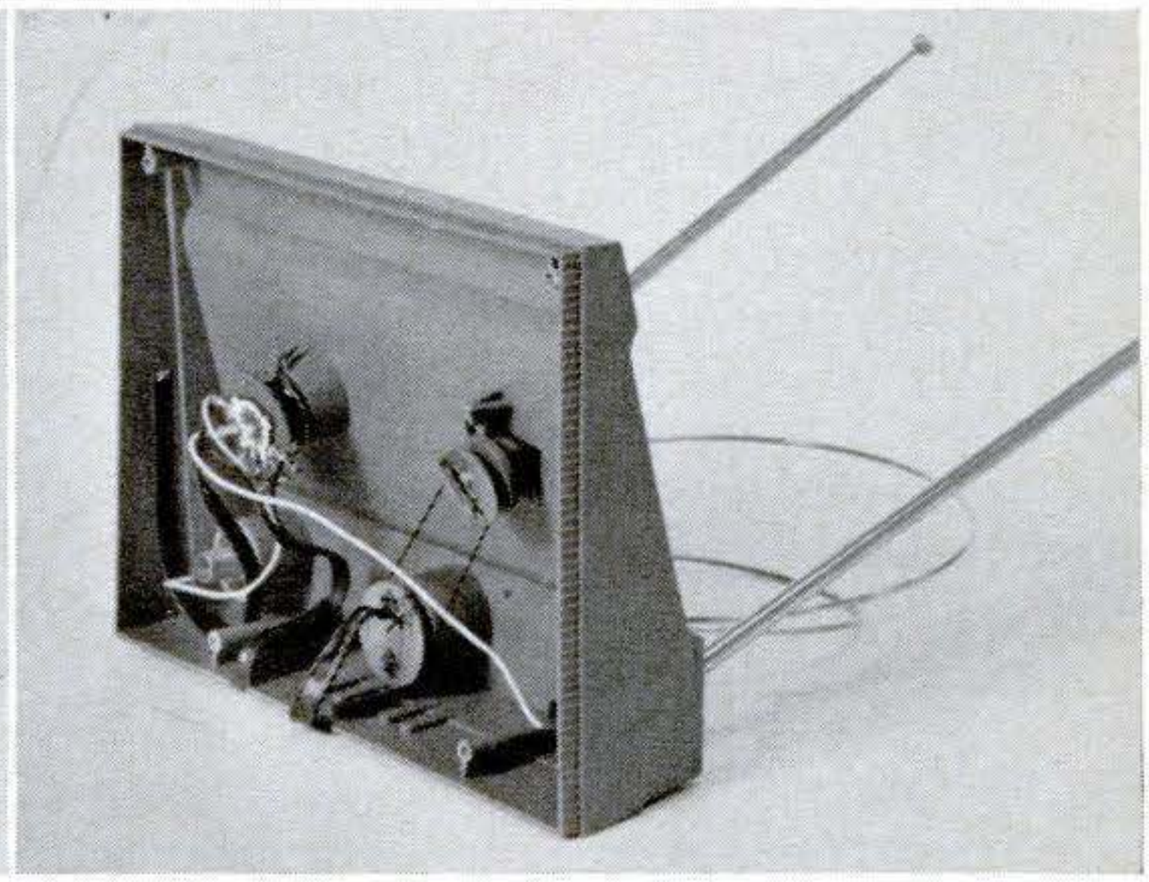
We found that the solvent will indeed silence a noisy tuner or volume control, if the mist expelled by the nozzle actually reaches the offending dirty contact or wiper. In our tests, this meant removing the tuner from the set, and opening it up. Simply injecting the mist "through any hole," as the instructions suggested, didn't do the job.

Marks 3-D glasses. This is a fascinating $10 gadget that does work to a limited extent: We did observe a slight three-dimensional effect when viewing with them.

Continued



Which is better, the super $15 RCA indoor antenna or a $1.19 pair of rabbit ears? Our tests showed that both were equally sensitive on VHF. The super-antenna is equipped with a separate, rotatable (by a front-panel knob) loop antenna for UHF.



Inside the superantenna is a rotary switch, a 330-ohm resistor, and a length of shorted twin-lead cable. The switch connects these components and the dipole antenna together in several different ways. Most switch positions reduce sensitivity.

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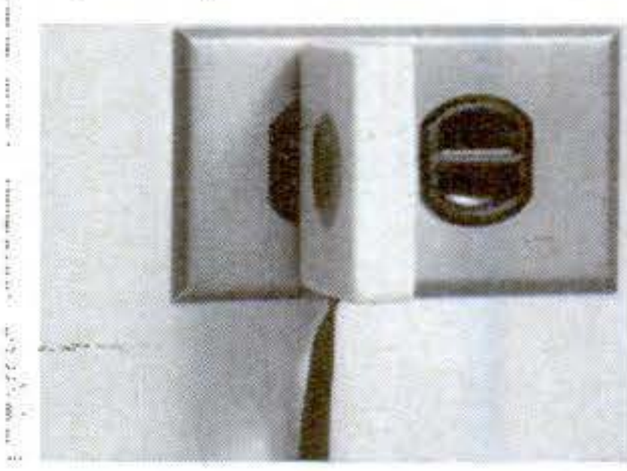
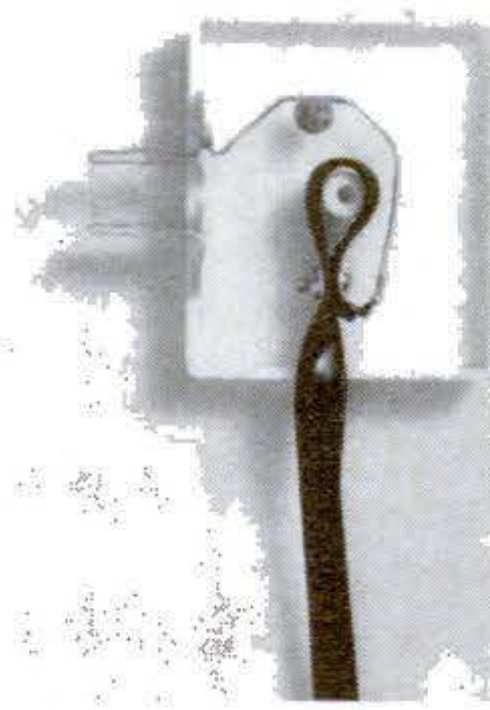
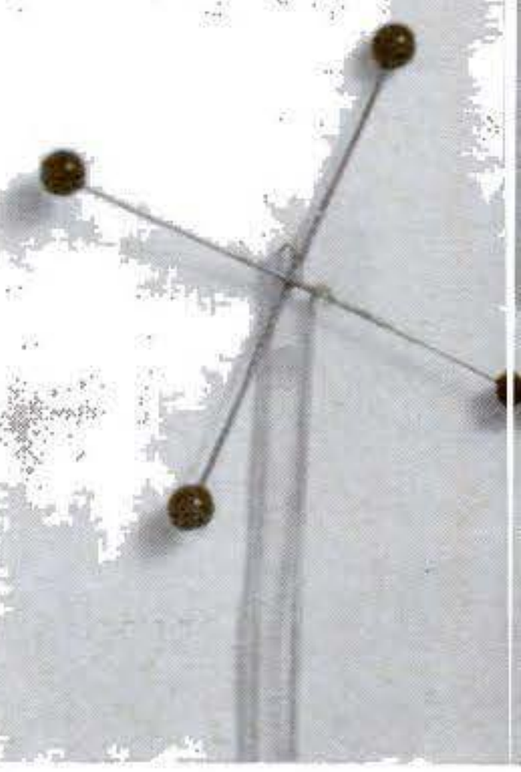
We tested the TV gadgets on a big-screen color TV, a small-scree







Here's how the plug-in and wall-mount antennas look. The plug-in's instructions recommend you experiment to find best plug direction; the wall-mount's instructions advise you to shift the plastic gizmo around until you get a perfect picture.

Inside the plug-in antenna (above, left) we found a small disk capacitor wired between one side of the twin lead and one of the prongs. Inside the wall mount (right) we found nothing. The metal X has no effect whatever on the antenna's performance.

They look like a confused pair of sunglasses—the left lens is a greenish-yellow color; the right lens, a pure red. Their developers claim the 3-D effect is caused by a newly discovered visual phenomenon: The two different types of light receptors in your eye—rods and cones—respond to a visual change at different speeds. When you wear the glasses, the colored lenses permit only the rods in your right eye and only the cones in your left eye to see the TV picture. The slight difference in response time of the rods and cones causes an optical illusion: Moving objects in the TV picture seem to stand out from the stationary background.

Line-cord antenna. The package says this gadget "plugs into a wall outlet and turns your house wiring into a giant TV antenna." My field-strength meter indicated that this $3 antenna did in fact pull in a slightly stronger TV signal than a $1.15 pair of rabbit ears. However, it also pulled in enough power-line interference and ghosts to ruin the picture.

Wall-mount antenna. This $3 antenna was far inferior to a pair of rabbit ears in all respects. We found out why when we took it apart: It's nothing more than an eight-foot length of ordinary twin-lead lead-in cable, equipped with a futuristic-looking metal and plastic bauble at one end.

Color-tone filter. The manufacturer calls it a "TV Color Screen," and the package claims that this $1 sheet of multicolored plastic film "transforms all black-and-white television sets into beautiful color tones." We think the effect it produces is roughly like looking at your TV set through a prism. The top quarter of the screen is deep blue, the second quarter is orange, the third yellow, the bottom red.

Speaker killer. Here is another device that is offered by several manufacturers. Prices and appearance vary slightly; ours cost $2.50. Essentially it's a simple off-on switch mounted at the end of a long, two-conductor cable. The instructions tell you to clip the free end of the cable (with the alligator clips supplied) across the loudspeaker terminals inside your TV set. The idea is that whenever you want to kill your set's sound, you throw the switch *on*, and it short-circuits the speaker wiring. When you throw the switch *off*, the short is removed, and the speaker blares again.

Sure it works—but there's a hitch. This device may severely damage your set's sound system, especially if your set is transistorized.

Plug-in filter. This $1 gadget mounts between your set's power plug and the wall socket. It is supposed to eliminate power-line interference. In our tests it had little effect. When we opened it up we found nothing but a low-value disk capacitor that is connected across the power line when the gadget is installed. The idea is that the capacitor acts as a short circuit—it "bypasses" high-frequency interference

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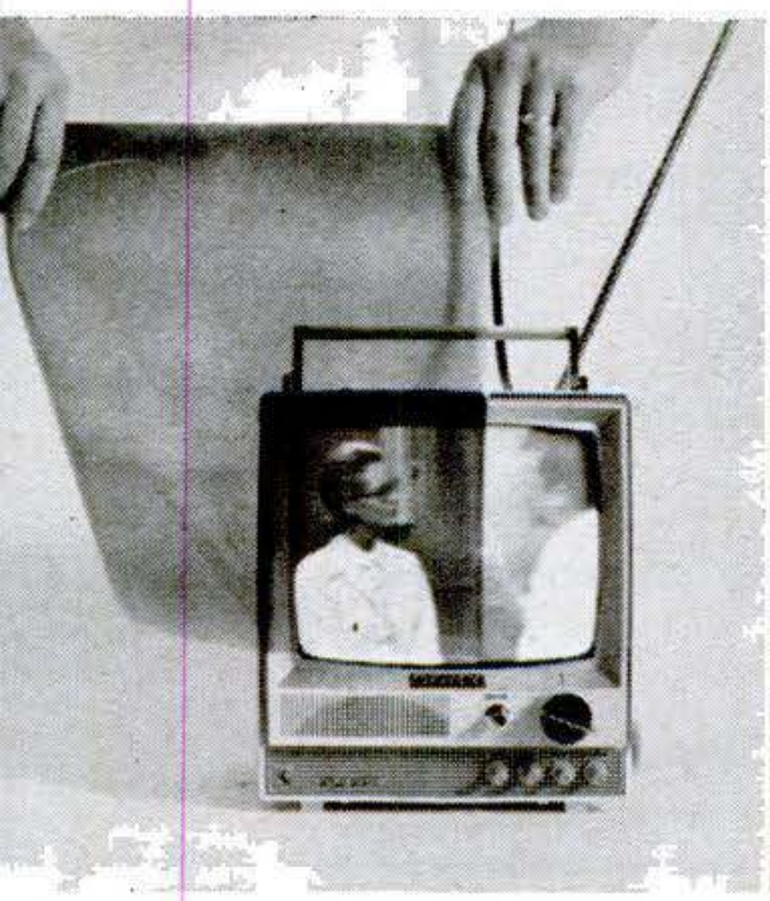
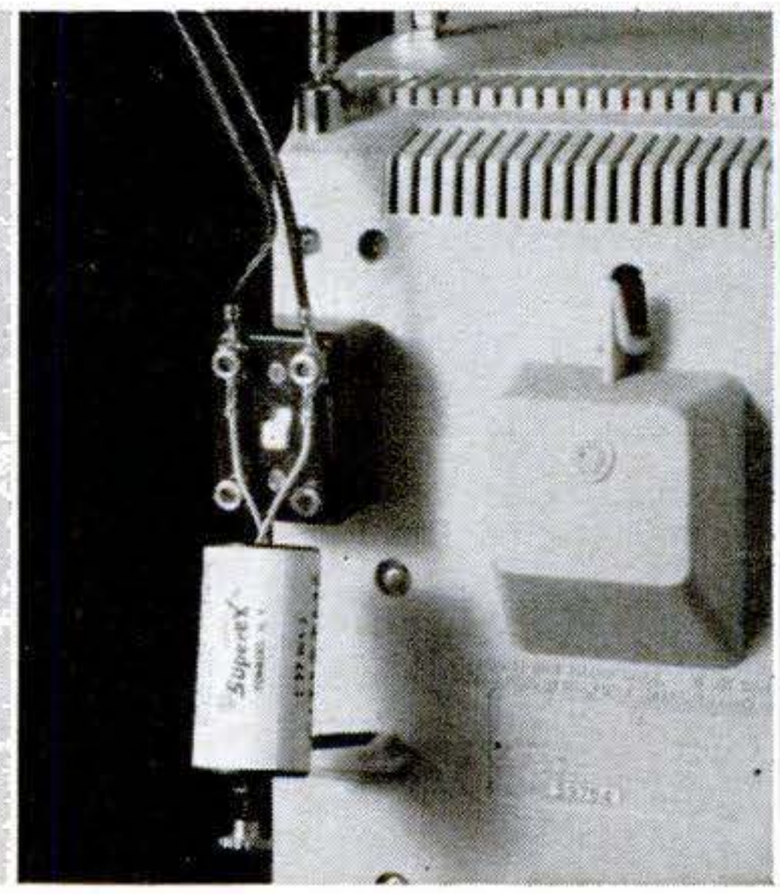
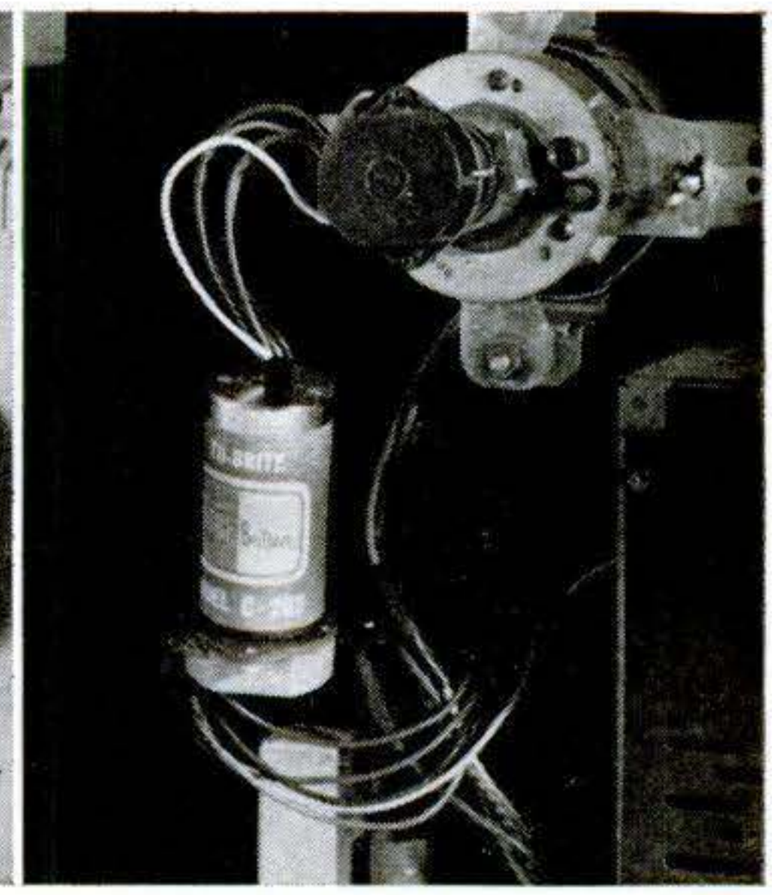
ansistor portable, and an ancient black-and-white table model



The TV Color Screen mounts on the face of a picture tube with tape. Several-size filters are available to fit various screen sizes. The effect is nothing like color TV.



A hang-on filter eliminates much radiated interference, if it's not too strong, from CB radios and diathermy machines. It's sometimes worth a try.



Picture-tube brightener is an old-time cure for an aging picture tube —and it does work, for a while, on most old tubes. Have a serviceman pick the one for your set.

that would otherwise reach the set through the power cord. It's basically a sound idea —that's why most sets have them built in.

Plug-in surge limiter. This device looks like and mounts like the filter described above. Inside is a thermistor—a disk of semiconductor material that acts like a temperature-controlled resistor: Wired in series with your set, the hotter it gets, the lower its electrical resistance. At $1, it is a worthwhile accessory.

It works by eliminating sudden current surges (when you first turn a cold set on) that will eventually shorten tube and component life. Initially, the thermistor is cold, so only a small current can flow through it into your set. After about 30 seconds, it warms up—resistance is negligible, and the set works normally.

Hang-on filters. These miniature resonant circuits—coil and capacitor combination—are designed to trap out interfering radio-frequency signals before they get into your TV's tuner. They mount under your set's antenna terminals, along with the antenna lead-in cable lugs. The units we bought both cost under $2 and were meant to remove CB radio and diathermy-machine interference.

Both units worked well, but the filter equipped with an adjustable-coil tuning knob had the edge since it could be tuned directly to the interfering frequency.

Picture-tube brightener. As the package says, this gadget is designed to "increase the useful life" of an aging picture tube; it isn't a cure-all for a weak picture.

When a picture tube ages, its electron gun supplies fewer and fewer electrons to produce a sharp picture. This is caused by a drop of the cathode's electron emissivity.

A picture-tube brightener boosts the tube's filament voltage, thus heating the cathode to a higher temperature and temporarily boosting its emissivity. The cure may last a day or a year—it depends on the tube.

Lightning arrester. Fortunately, we didn't get a chance to test this gadget fully, since lightning didn't strike our antenna. Actually, a lightning arrester is more of a necessity than a gadget accessory. We bought one because it was on sale amidst the other gadgets. Inside our $2 unit, which mounts around the antenna lead-in cable and is connected to a good ground, are two spark gaps. Since a TV signal has very low voltage, these gaps have no effect on it. However, if lightning strikes your antenna or lead-in cable, the enormous voltage instantaneously arcs across the spark gaps and passes harmlessly to ground.

Indoor antenna. Frankly, we were curious. PS reported on super indoor antennas back in April, 1959, and we wondered if they'd been improved. So we bought the fanciest, most expensive, indoor antenna we could find. Our field-strength meter tests showed that the $15 switch-equipped antenna did not beat the performance of the low-cost rabbit ears. PS

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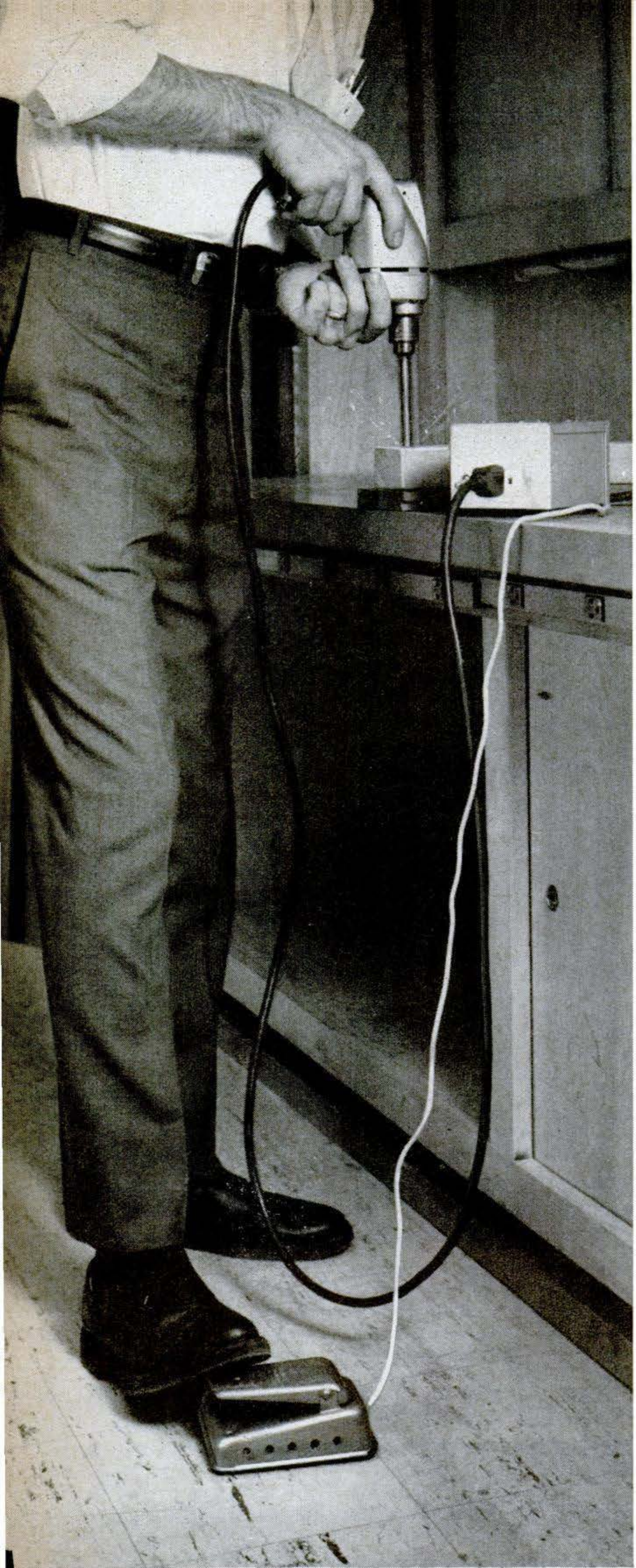

BUILD YOUR OWN Pedal-Operated

It lets you choose the exact tool speed you want with the touch of your toe

By RONALD M. BENREY
PS Electronics Editor

No doubt about it—an SCR (silicon-controlled rectifier) speed control can be as handy as a chuck key when you use your electric drill or other hand-held power tools. You can instantly select the perfect tool speed for the job at hand. And with this speed control, you don't have the feeling that you need an extra hand to manipulate the speed-adjust knob. You vary speed by treading on the control's spring-loaded pedal—the harder you press, the faster the tool runs.

The control will work with any series-wound AC-DC "universal" motor (rated up to three-amperes' current drain). This includes most hand-held tools, and many small appliances.

How it works. Heart of the speed control is the half-wave SCR power-control circuit. The SCR acts as an electronic on/off switch that varies current fed to the power tool. The SCR turns on (conducts current) during part of the positive half of every AC cycle. The longer it is on during each half-cycle, the more current supplied to the tool, and the faster the tool runs.

The length of the SCR's *on* period is a function of two variables:

- The pressure your foot applies to the control's pedal unit (actually a foot-operated potentiometer).
- The mechanical "load" that the power tool is working against.

This second point means that the control circuit automatically tries to maintain the tool speed you've selected even if the tool loading increases or decreases.

Because an SCR is essentially a rectifier, the circuit—when the pedal is in its

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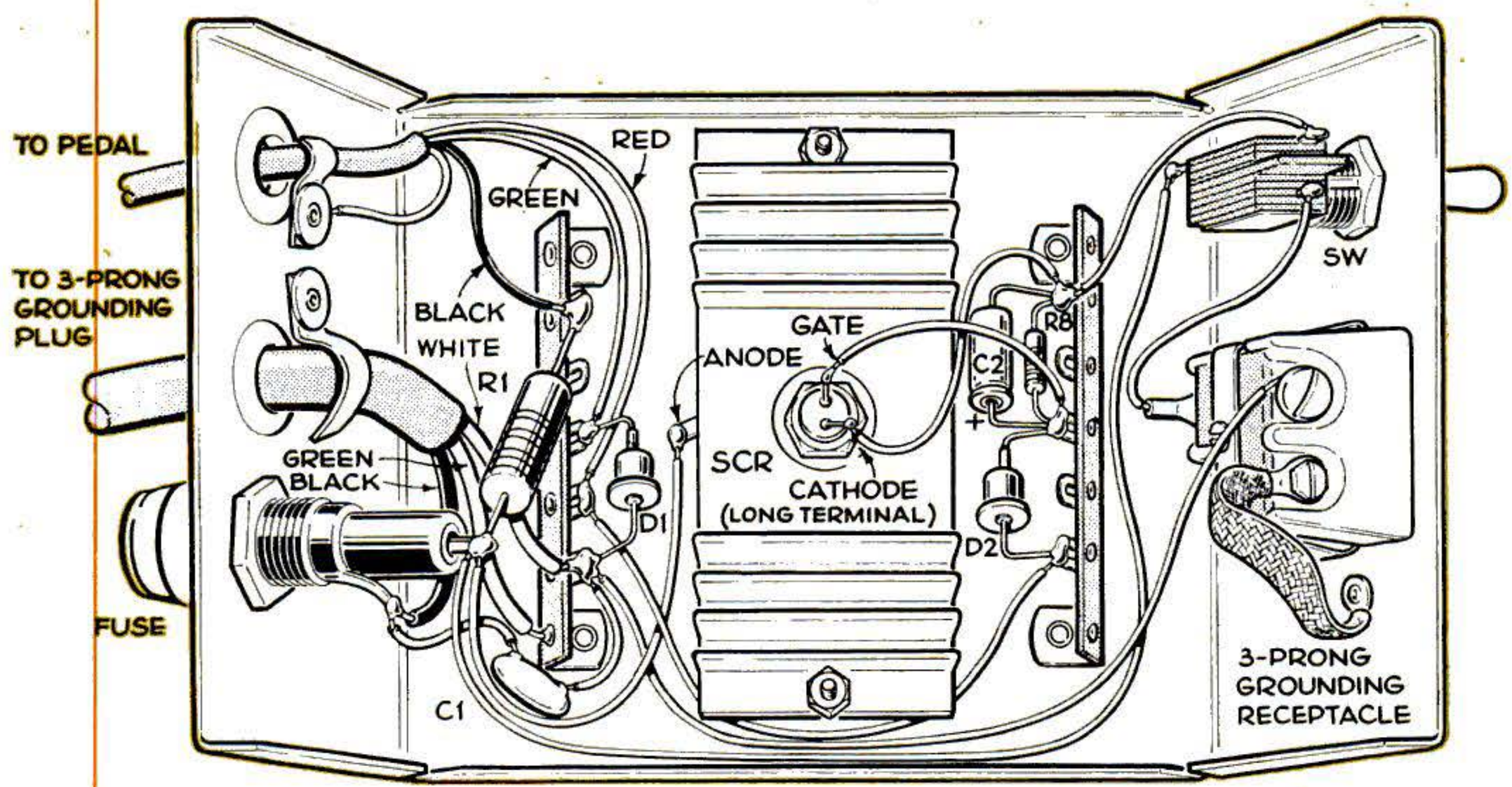
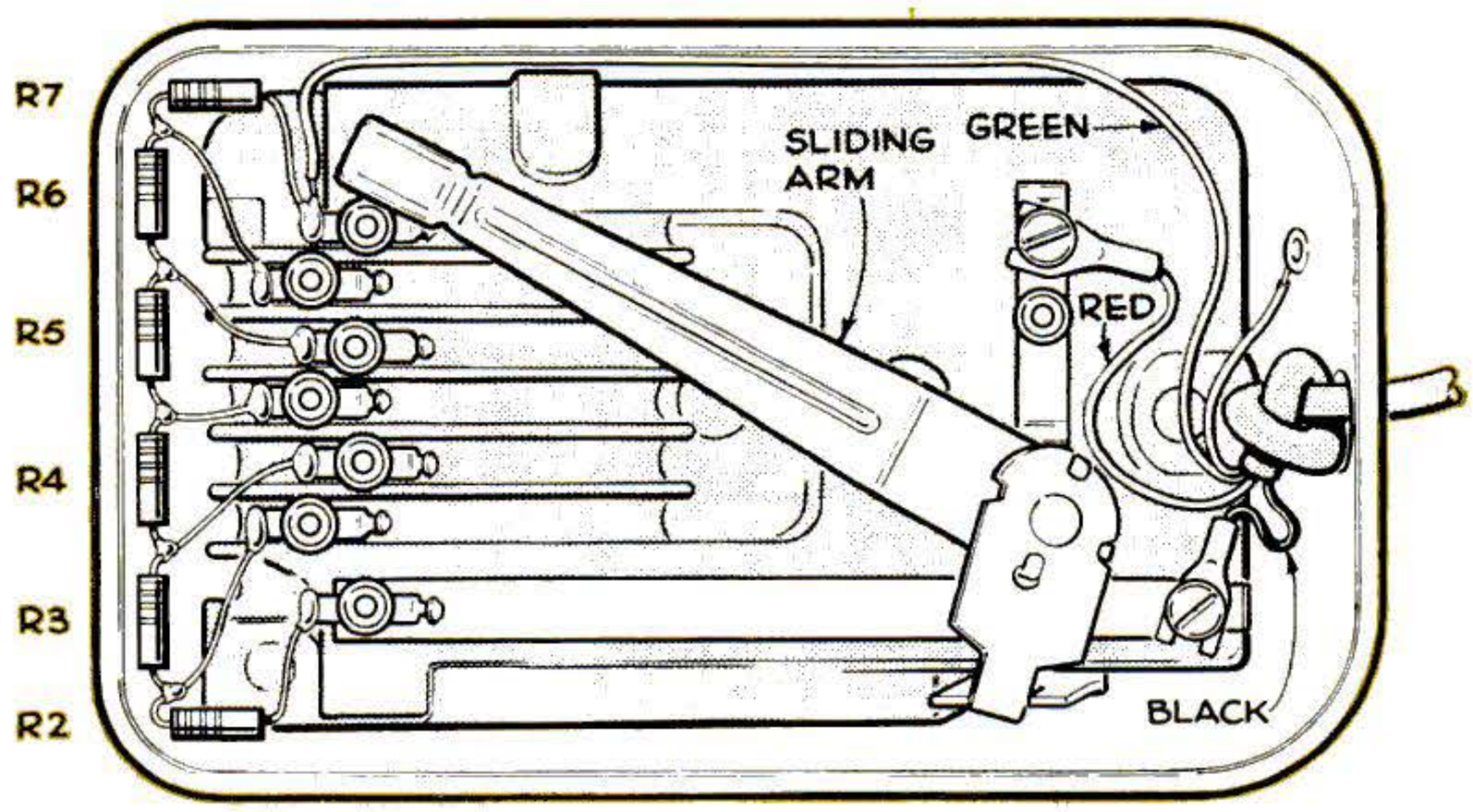
Speed Control for Power Tools





PICTORIAL WIRING DIAGRAMS BY DICK MEYER

maxium-speed position—delivers half-wave rectified AC current pulses to the tool. This will run the tool at approximately 70 percent of its maximum speed.

Thus, the control will vary the speed of most power tools from a dead standstill to about ¾ of their maximum possible speed. When you do need high tool speed, just flip switch SW from its "variable" to its "full" position cutting out the SCR.

Building it. Use a small aluminum minibox as a combination cabinet-chassis. The SCR dissipates a good deal of heat when

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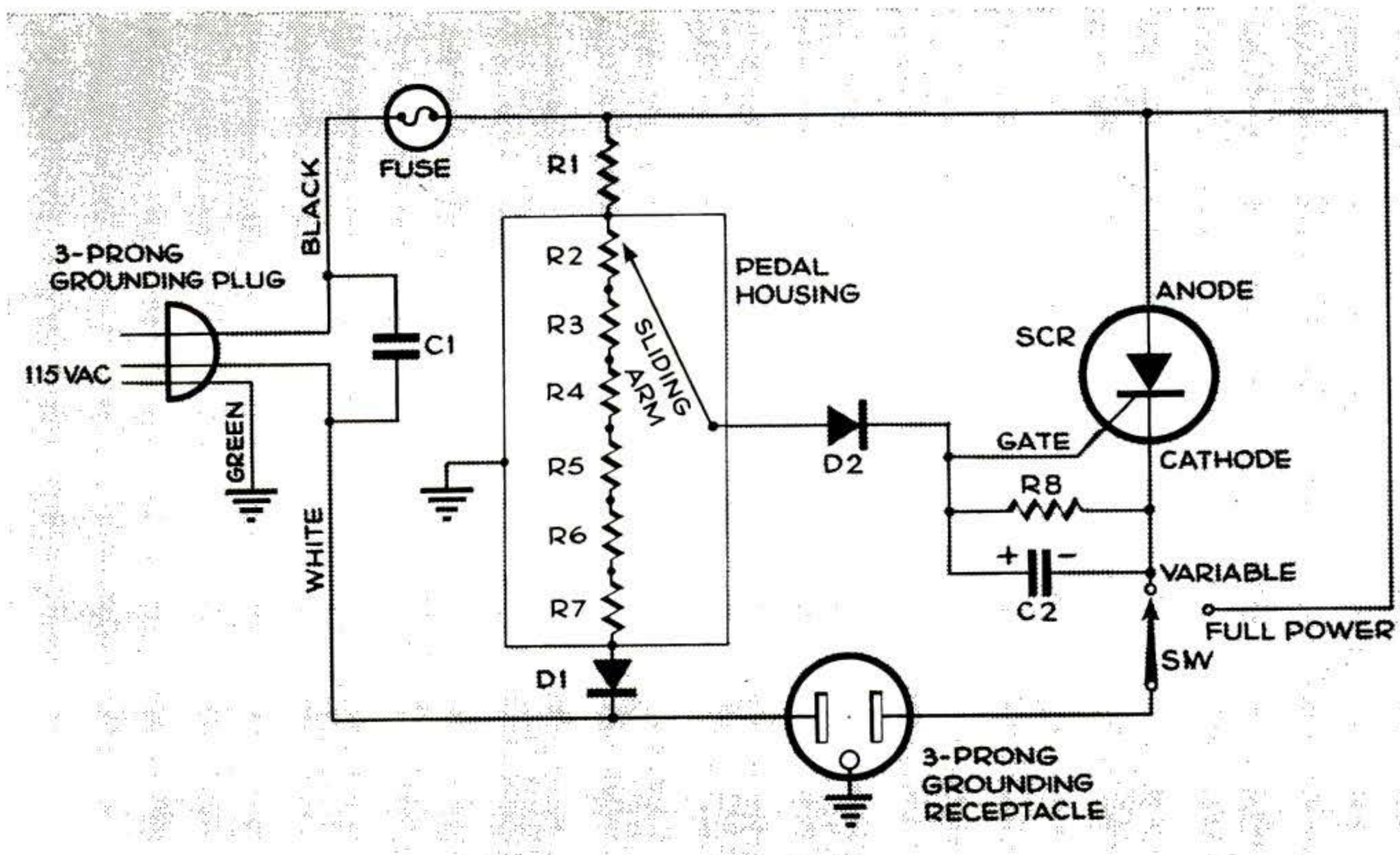

PARTS LIST

R1—2,700-ohm, 2-watt carbon resistor
R2—1,000-ohm, ½-watt carbon resistor
R3, R4, R5, R6, R7, R8—100-ohm, ½-watt carbon resistor (all mounted inside pedal unit; see text)
C1—2-mfd., 50-volt electrolytic capacitor
C2—.01-mfd., 1,400-volt disk capacitor
SCR—General Electric type GE X-1 SCR
D1, D2—GE 504 silicon rectifier
SW—SPDT toggle switch
Case—3" x 4" x 5" aluminum minibox
Heat sink—3¼" x 1½" (or larger) finned aluminum heat sink
Misc.—Panel-mount 3-prong grounding-type receptacle; 3-wire, grounding plug-type cord set (9' cord); 4 rubber feet for case; 2 5-lug terminal strips; hardware; wire (use #16 or larger insulated wire for internal wiring); 4-conductor, #20 or #22, plastic-jacketed cable (5')

Note: All components except sewing-machine-pedal controller (see text) are available from Allied Radio Co., Chicago 60680.

the circuit is operating, so it must be mounted on a finned aluminum heat sink. However, the SCR must be electrically insulated from the heat sink and minibox. Be sure to install the mica insulating washers and plastic spacer supplied with the SCR. Support the heat sink inside the case with aluminum spacers. As a final touch, drill ventilation holes in the case.

To minimize any possible shock hazard caused by an accidental short in the speed-control circuit, or by leakage current in your power tools, use a three-prong grounding receptacle (for SO) and three-wire cord set. Use tinned copper braid to connect SO's grounding terminal to the case, and solder the cord set's green wire to one of the terminal-strip mounting feet.

Double-check the polarities of the two silicon diodes, D1 and D2, and the electrolytic capacitor C1, when mounting them.

The pedal unit. You can either modify a conventional sewing-machine, resistance-wire, pedal-operated controller (as shown in the diagram) or use your ingenuity to design one from scratch. The idea is simple: The pedal unit is a foot-operated potentiometer with a resistance range of approximately 0-600 ohms. If you want to design your own, start with a 500-ohm or 750-ohm two-watt potentiometer and work up a suitable pedal-controlled linkage. Here's how to modify a sewing-machine pedal: We used a 100-ohm model 702 controller from Mercury Electric Products Co., available at most sewing-machine supply shops.

Slide the bottom plate off, remove (and save) the insulator support screw, and slip the insulator out from under the pedal linkage. Next, cut away (and discard) the six lengths of coiled resistance wire. Finally, mount and solder in place the six carbon resistors, and connect the four-conductor cable as shown. Note: For safety, one conductor of the cable is used to ground the pedal-unit body to the main minibox. PS

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WHAT'S NEW

ELECTRONICS

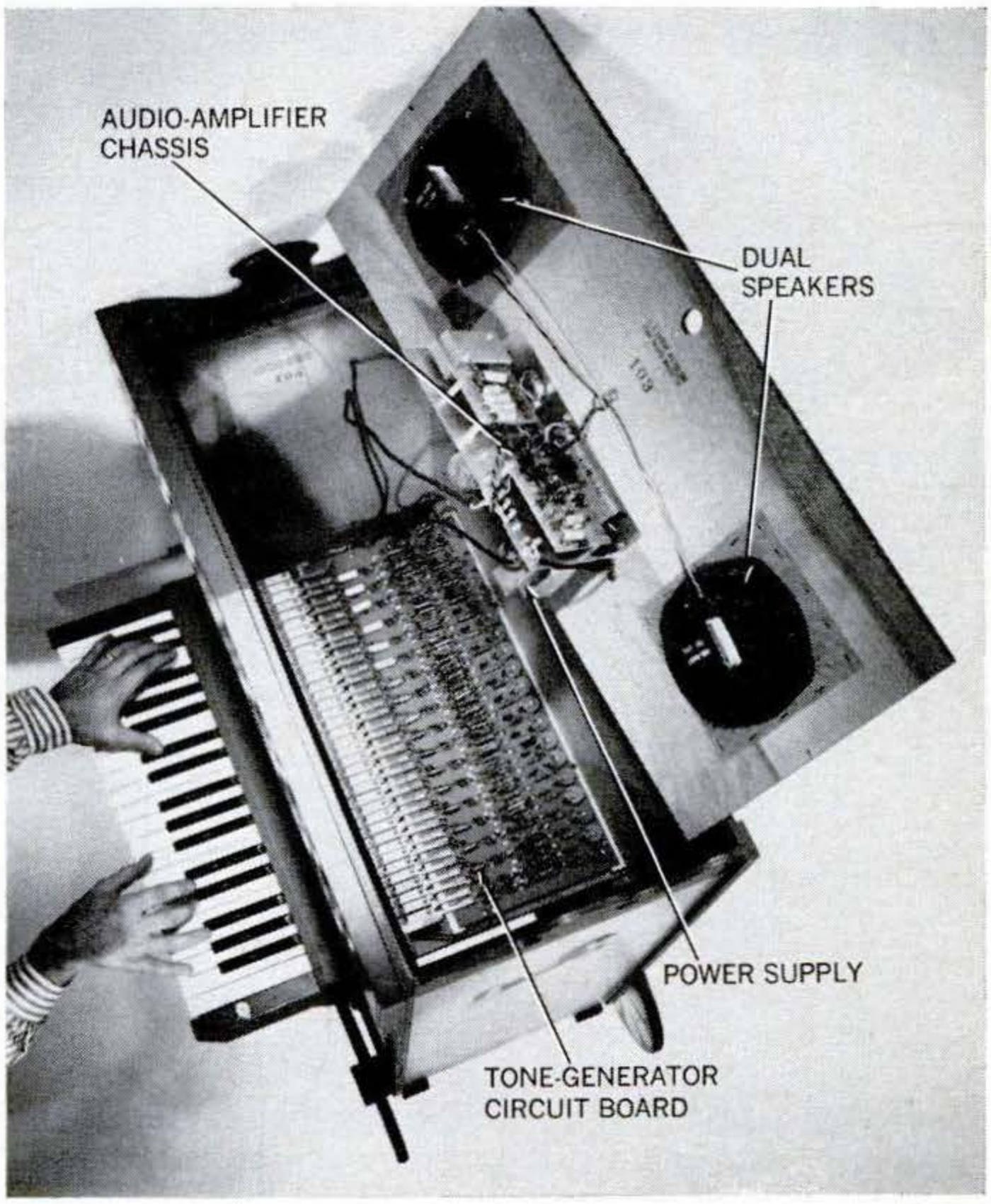
Electronic Calliope You Build from a Kit

Nope—the striped shirt and straw hat don't come with the kit. The audio amplifier is part of the power-supply chassis (photo below).

Remember the pleasant *boop-beep-beep* tones of an old-fashioned circus steam calliope? Here's an electronic instrument that makes the same happy sound, only it doesn't need a wood-fired boiler behind it for power. It's made by the Rocky Mount Instrument Co., Rocky Mount, N.C. The kit costs $225; the ready-made unit, $395.

Basically, the instrument is a simple three-octave electronic organ. The secret of its windy calliope-like sound is a "white noise" source built into the power supply. This circuit adds a whooshing quality to the musical tones produced by the unit's tone-generator circuit board.

The kit version is supplied with prewired tone-generator and power-supply chassis, and an unfinished cabinet. You mount the electronic sub-assemblies in the locations shown at right, wire them together, and then decorate the cabinet. The manufacturer supplies circusy decals but leaves the cabinet color scheme up to your own imagination.



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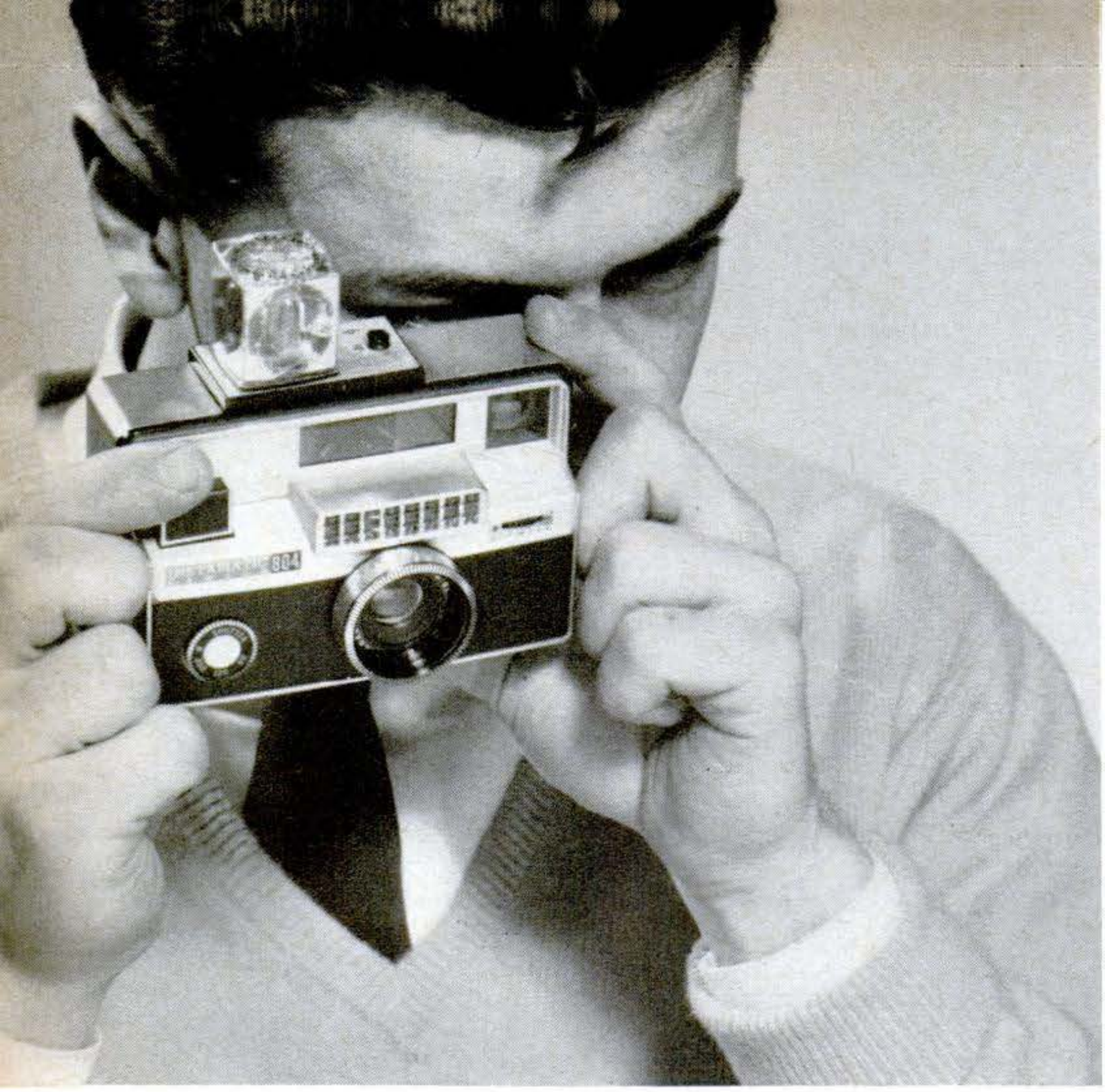

Spring motor powers the 804, and a few pulls on the winding tape set it up to run through an entire 20-exposure cartridge. Motor positions the first frame, advances the film after each shot, and winds off the trailer after the last exposure—all automatically. You can shoot as fast as once a second.

Personal-Use Report: INSTAMATIC 804

how come this $125

By PAUL WAHL

Less than two years ago, Kodak introduced their top-of-the-line Instamatic, the 804—an updated flashcube version of the earlier Instamatic 800. Since then, this $125 camera has outsold all others in its own price class and every 35mm, regardless of price, as well.

How come? What makes it so hot? I took a long, hard look at the 804 to find out.

Kodak calls the 804 a "computer that takes pictures." It's true. The 804 does almost everything itself. It takes over all the bothersome details of photography, leaving you free to concentrate on your subjects and make great pictures. Here's how:

Loading. There's no fumbling, no film-threading. The 126 cartridge simply drops in, won't go in wrong. You don't have to rewind the film before unloading—just open the camera back and let the cartridge fall out. Film type, number of exposures on the roll, and the number of the next frame can be read through a window in the camera back.

Film advance. The motor positions the first frame, advances the film after each shot, and winds off the trailer after the last exposure. There are no batteries to poop out—a few pulls on the winding tape power a spring motor to drive a full roll.

Exposure control. The camera automatically adjusts itself for film speed (ASA 25-800) when the cartridge is loaded. Lens opening—*f* 2.8-*f*/64—is controlled by the amount of light striking the electric eye (selenium cell). You set the shutter-speed dial for 1/250, 1/125, or 1/60 second. If the shutter is set too fast for existing light, the speed is reduced automatically after lens aperture reaches *f*/2.8. At this aperture

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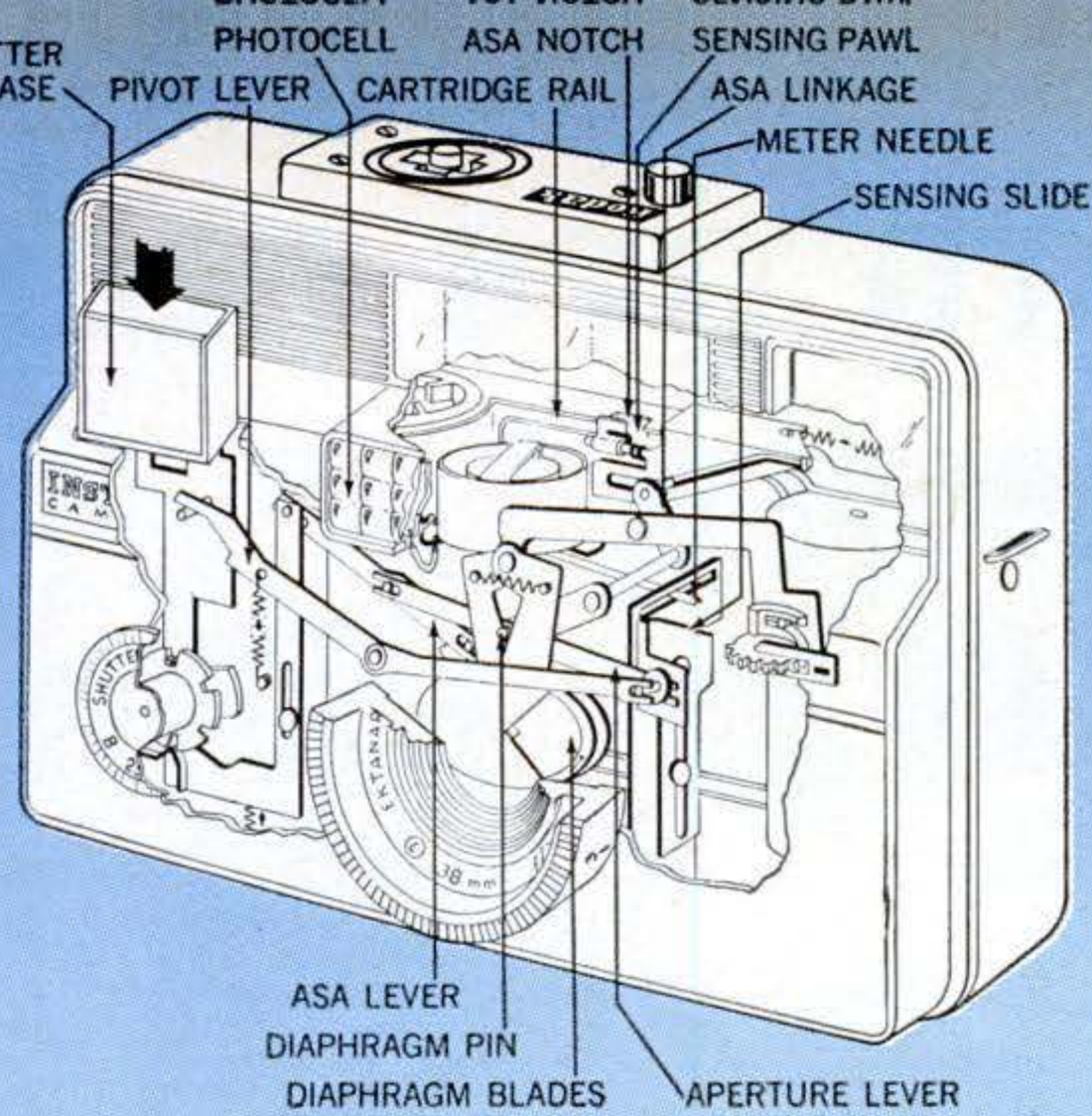
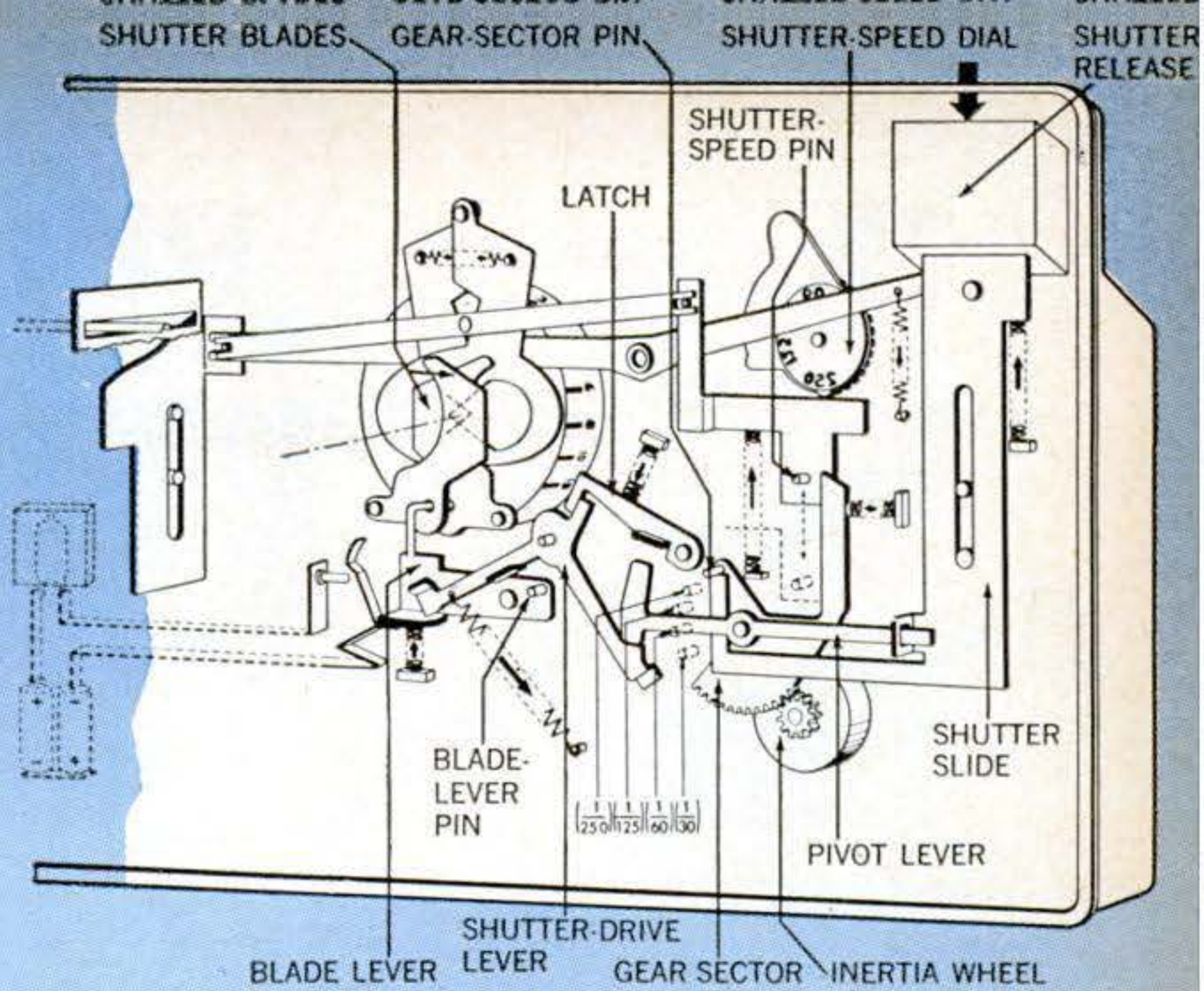


How lens opening is set: Loading cartridge causes sensing pawl to slide along cartridge rail, stop at ASA notch. Through linkage and ASA lever, this sets left end of aperture lever. Light in photocell causes current to move needle in slot. Pressing shutter release lets right end of pivot lever go up, with sensing slide, whose curved face is stopped by meter needle. Right end of aperture lever, with pin working diaphragm blades, moves, too.



When you press the shutter release, slide releases pin, letting gear sector swing until stopped by shutter-speed pin (position of which is set by shutter-speed dial). Hammer end of pivot lever hits latch, which releases shutter-drive lever. Lever leg whacks blade lever down, opening shutter blades; continuing, it hits pin on blade lever to close blades. Exposure time is set by gear-sector pin, which retards right leg of shutter-drive lever.

amera outsells every 35 in the U.S.?

and 1/30 second, if there's still not enough light for proper exposure, a USE FLASH signal lights up in the viewfinder. If the camera was fired at a speed different from the one you set, it resets itself.

Backlighting. No problem here. A "compensator" wheel lets you give a stop more or less, to make sure bright light behind your subject doesn't fool the electric eye. Or you can take a close-up reading of your subject, hold the shutter release part way down to lock the exposure-control setting, and shoot.

Flash. Insert a flashcube, and the shutter automatically sets itself at 1/30 second. As you focus, the 804 automatically adjusts its len opening for correct exposure. If it's daylight, and you're using flash as fill-in, the camera takes *that* into account, too.

And it's a good camera to handle and use. The viewfinder image is large and clear (although the luminous frame could be brighter), and the range finder is easy to use—you bring together two images in the center spot of the viewfinder. And the 804 feels good—you can get a sure, comfortable grip on the body, it has enough heft for steady holding, and controls are conveniently located.

What about picture quality? It's on a par with what other similarly priced cameras deliver. The 126 format gives you 28mm-by-28mm pictures (about 1⅛ inches square). Color transparencies come back to you in 35mm slide mounts to fit standard 35mm projectors.

In my opinion, the 804 is the easiest-to-use, most nearly goof-proof camera on the market, ideal for family snapshooting. For the non-photographer who refuses to learn anything about cameras but wants first-class pictures on the first try, or the amateur who likes to get his pictures the automatic way, the 804 is hard to beat.

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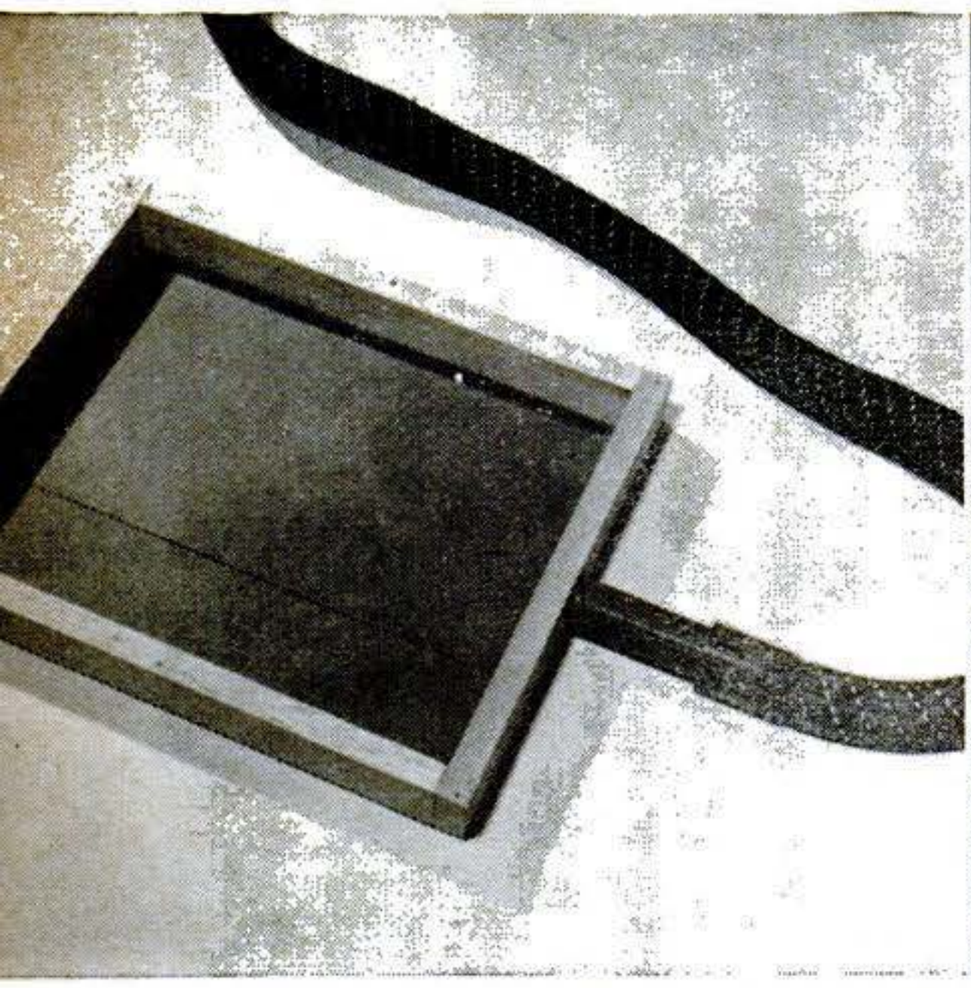
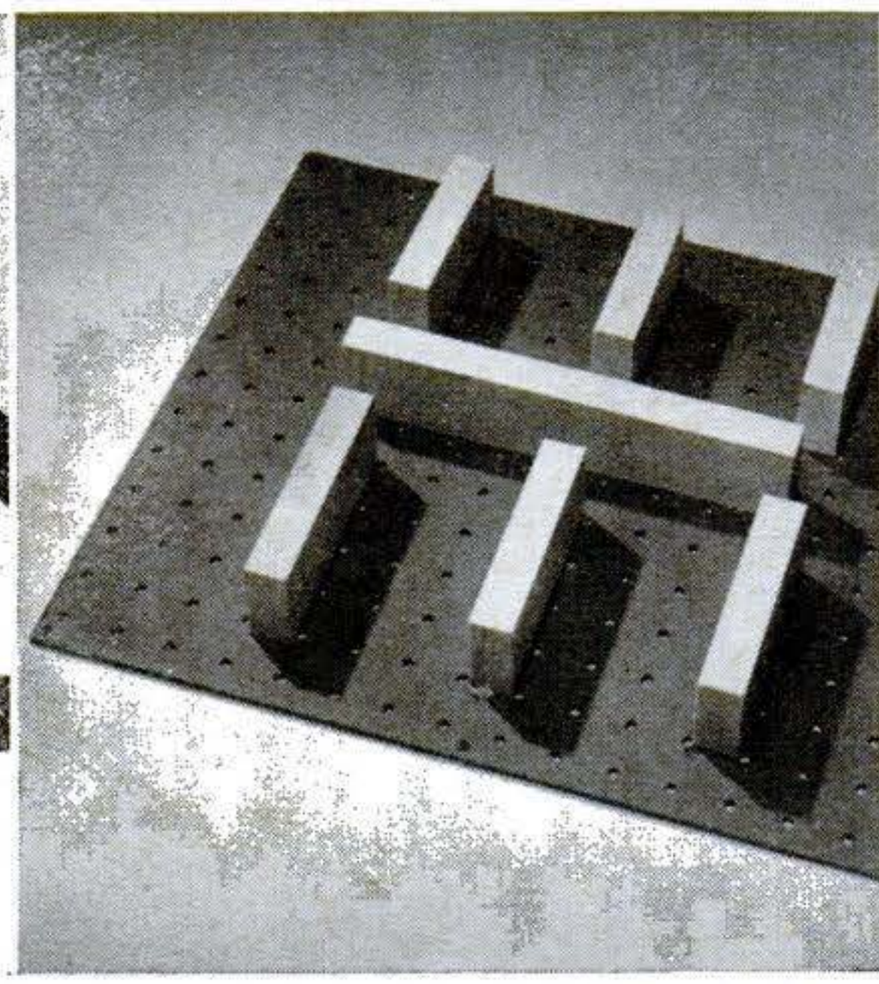
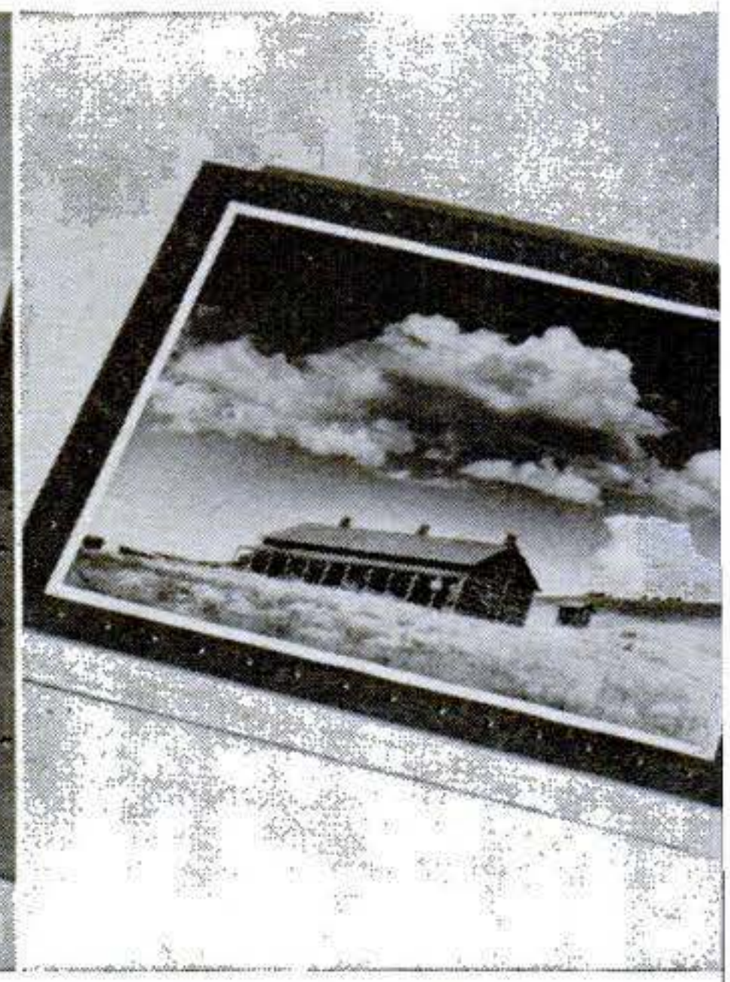
PHOTO TIPS FROM





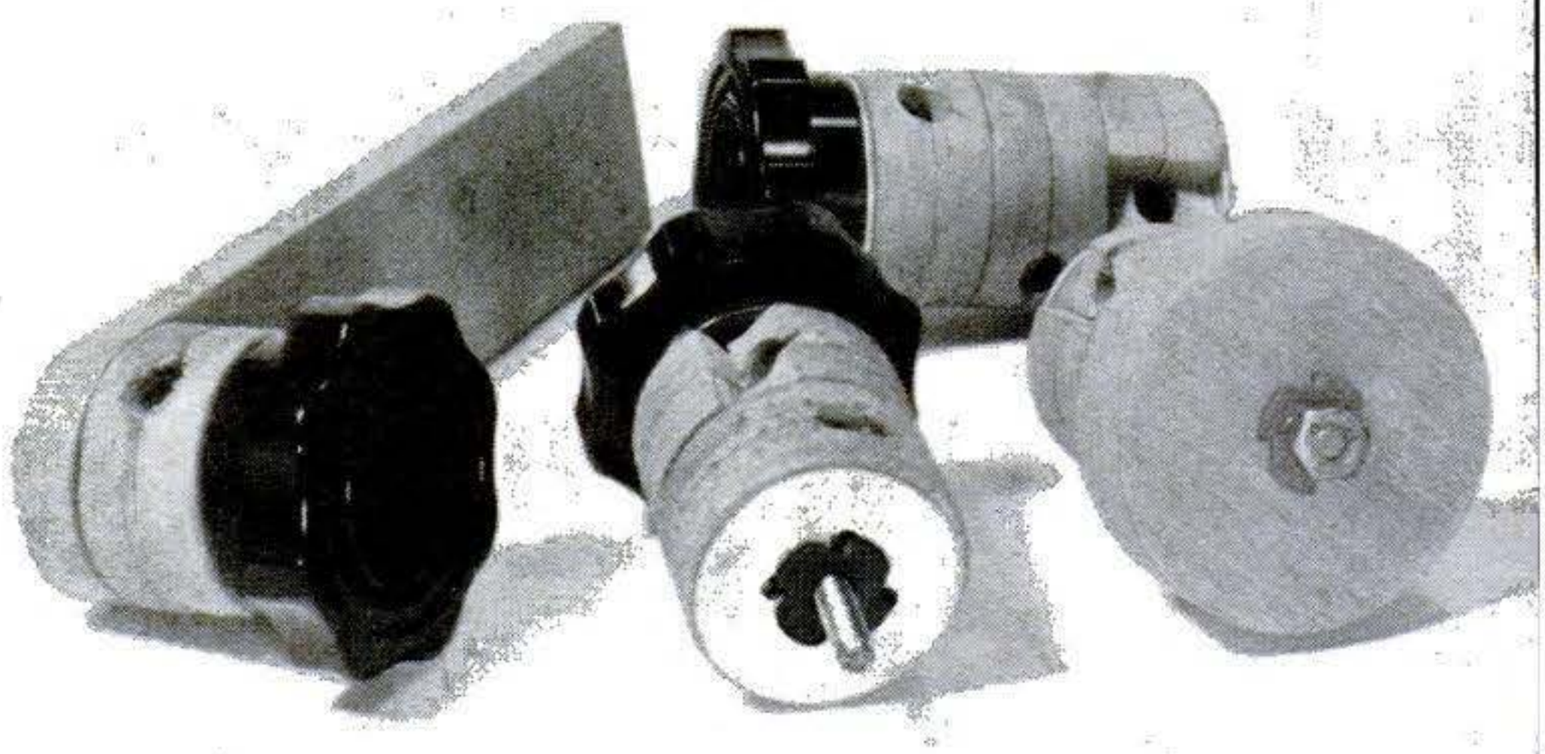


Vacuum easel makes copying easy, or lets you make borderless prints on your enlarger

Here's an easel that eliminates tapes and pushpins when you're copying, and lets you make borderless prints in your darkroom. The trick: A vacuum cleaner sucks the paper flat.

It has two parts: a hardboard back with a one-by-two frame, and a pegboard top. One-by-two strips glued to the pegboard keep it from collapsing under vacuum. A hole in the side of the bottom piece lets you insert the hose. In use, to prevent loss of vacuum, cover unused pegboard holes with a paper mask.

PARRY C. YOB, Fair Oaks, Calif.



Now you can hang anything at any angle from a light stand

This system lets you support a camera at any angle, hang anything from a light stand, even turn the light stand into a boom light. The basic swivel assemblies consist of two pairs of 1¾"-diameter hardwood disks cut from half-inch stock, a long ¼"-20 bolt, two 1½"-diameter fender washers, a ¼"-20 tee nut, and a 2⅜"-diameter knob. Center holes of the disks are 17/64", and the side holes (drilled with pairs of disks clamped together, on a chord ¼" from the center) are ⅜". For the tee nut, you'll need to drill small holes in one washer (for the prongs) and enlarge the end disk's hole.

FRANK GREENWALD, La Grange, Ill.

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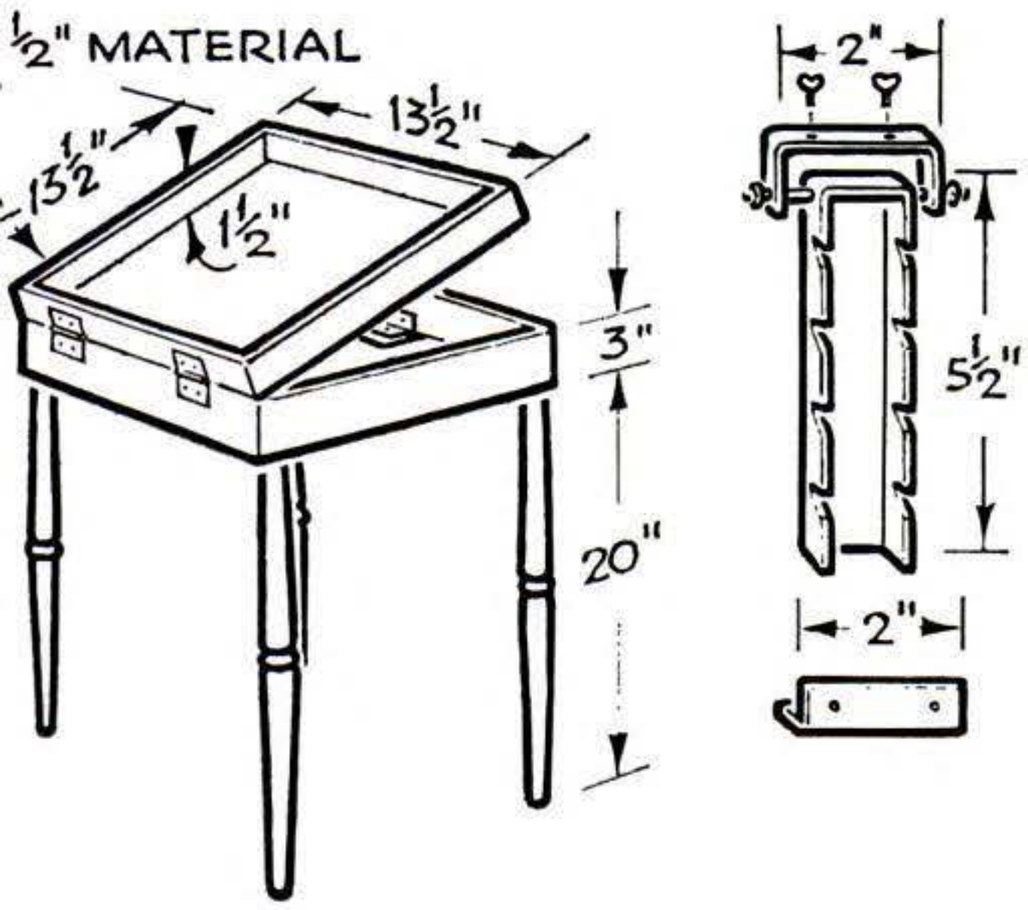
PS READERS



Tilt-top projector table has handy storage space for extra photo gear, too

This table tilts up to project your slides at any angle, stores projection gear such as extension wires and spare bulbs—and even looks good in the living room.

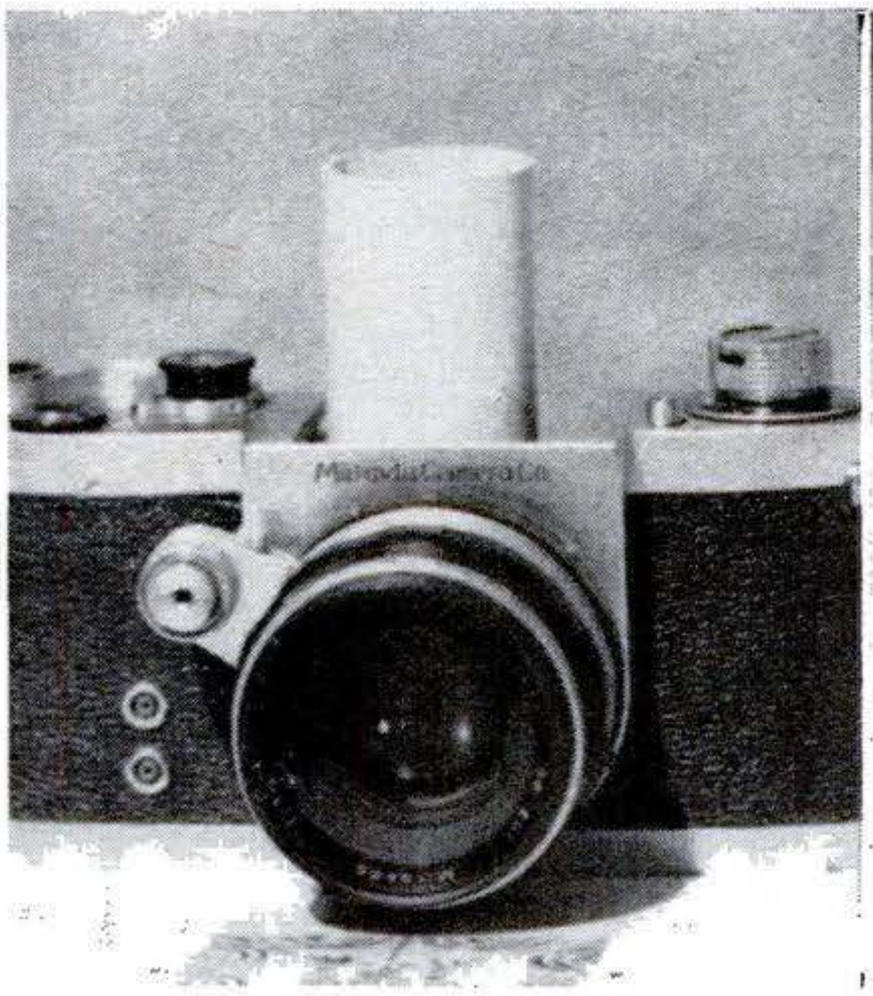
The table top, of half-inch wood, is 13½ inches square—a size that fits most standard 35mm outfits. A 1½-inch lip keeps the projector from sliding off. The elevator, a piece of channel, is sawtoothed to hold on the metal stop. I turned my legs on a lathe, but commercially made legs would do, too.

DON SHINER, San Diego, Calif.

hoto boxes make a paper safe

This serviceable little paper afe takes minutes to make, osts almost nothing. Lids and ottoms are hinged at the back vith tape, and tape loops in ront form handles. The bottom ox is attached to a piece of lywood, and weights on the op keep the boxes closed.

DAVID JORDAN
Des Moines, Iowa



How to sharpen SLR focusing

Do you have trouble with waist-level focusing of your SLR because of outside glare? Here's a simple, no-cost solution. Take that little cardboard tube that comes with Kodak 35mm black-and-white film and place it over the viewing screen. It's a big help.

HORATIO MCKENNA
Sun City, Ariz.

No-cost 2¼-inch slide trays

If you need extra boxes to hold your 2½-by-2½-inch color slides, look in your refrigerator for the answer. Quart milk cartons, cut at an angle as shown above, make marvelous storage trays. They're light in weight; they hold lots of slides; and you can't beat the price.

JOSEPH B. KOZAK
Binghamton, N.Y.

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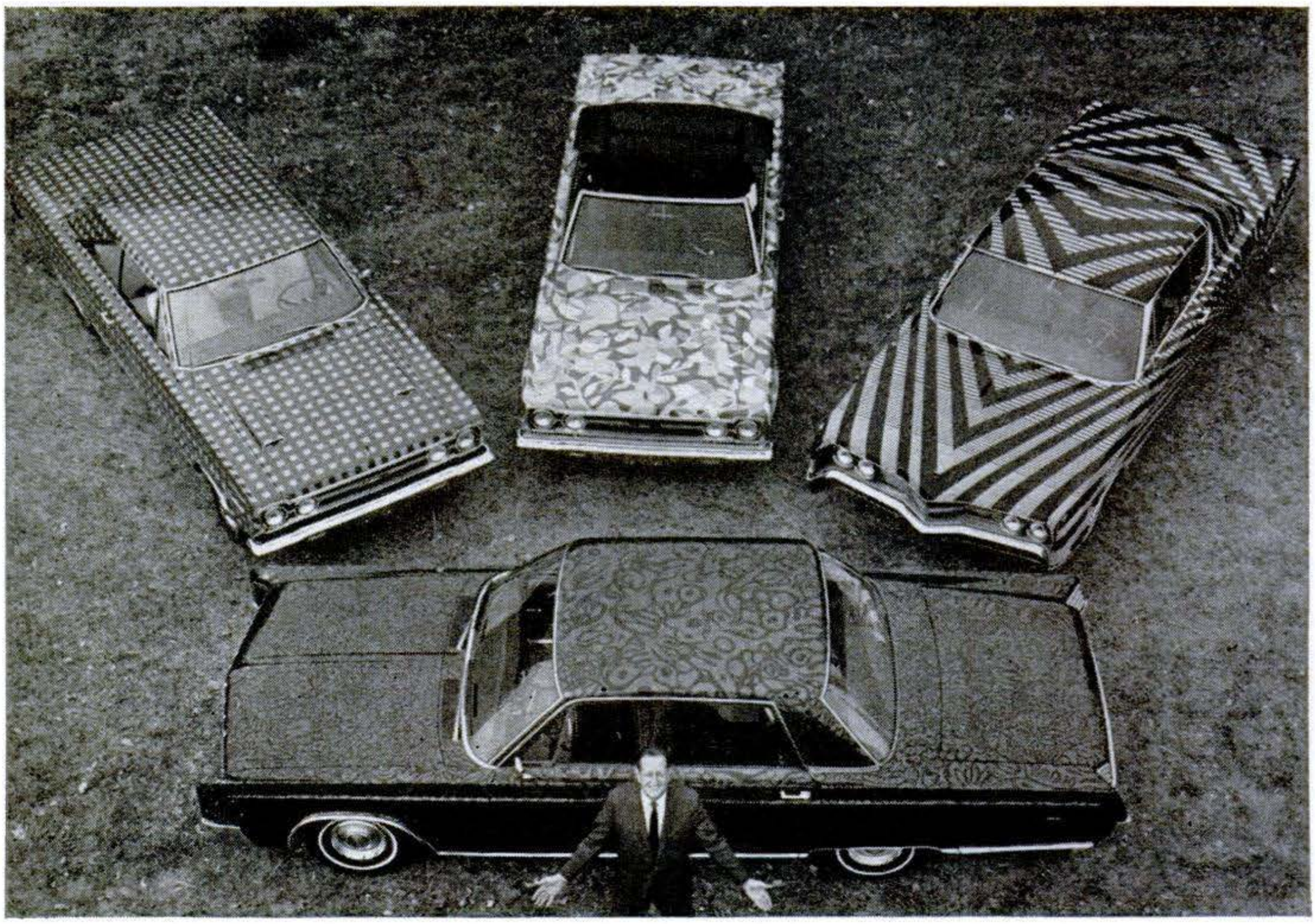
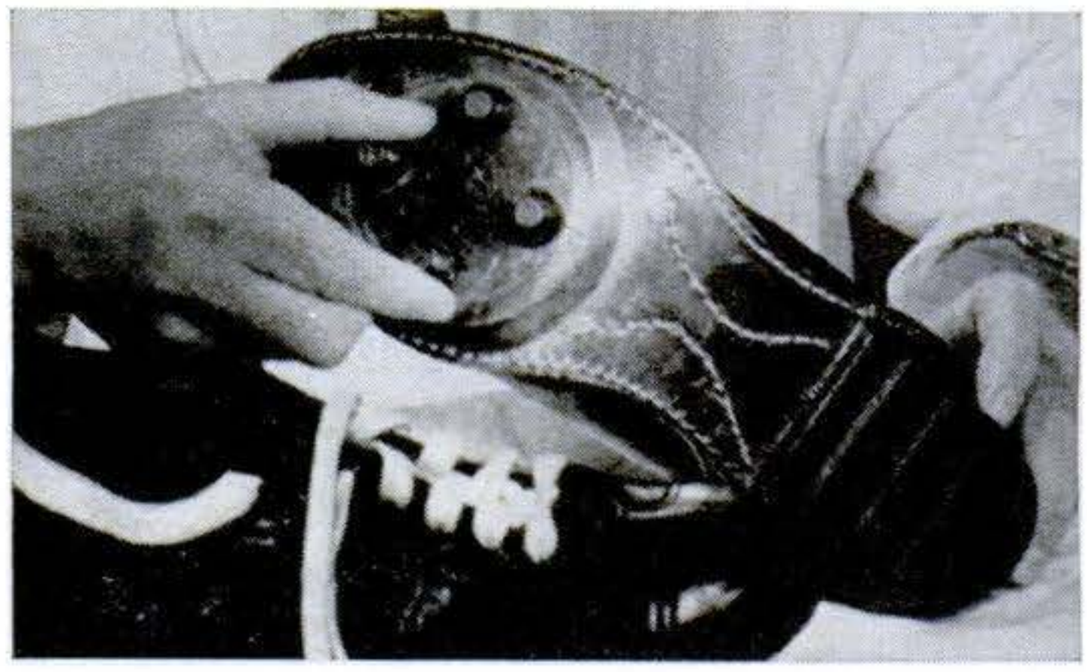


Op art makes the automotive scene with some weirdies

Chicago auto dealer Mel Wolff stands in front of four new designs he commissioned for his Chrysler-Plymouth cars. In the background are (left to right) a Plymouth Belvedere GTX, a Plymouth Satellite convertible, and a Chrysler 300. The conservative one in the foreground is a Chrysler Newport. The designs, created by artist Tom Strobel, range from Op and kinetic designs to floral patterns. All are on sale at Wolff's showrooms. He calls his color creations AutoArt.

Strapping tape really holds a load

A new Scotch tape, reinforced with glass filaments, is being used to hold down a car rooftop load above. The 3M product, with a 140-pound tensile strength, is handy for many heavy-duty jobs around the home. The tape can be used for repairing tool handles, tying pipes together, wrapping heavy packages. It sticks instantly, doesn't stretch. Price: 79 cents for a 30-foot roll.



Football shoe has a revolving cleat

A Houston, Tex., physician, Dr. Bruce Cameron, invented this football shoe with a revolving cleat. It is designed to cut down on the increasing number of knee injuries sustained on the gridiron. The cleat allows a player to rotate his foot when it gets caught in the dirt, thus relieving pressure on the knee—the frequent cause of serious damage, including athlete's knee.

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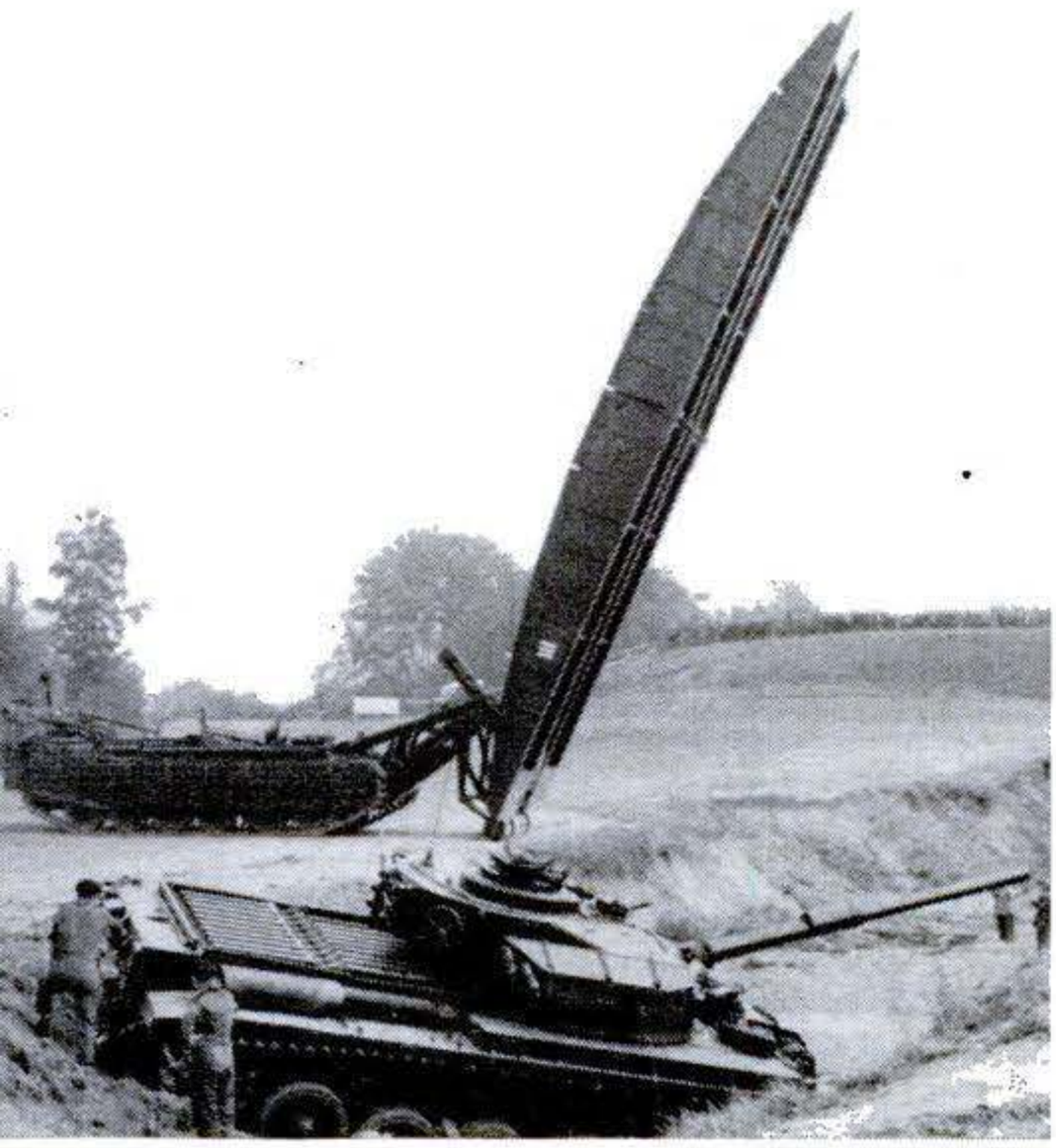
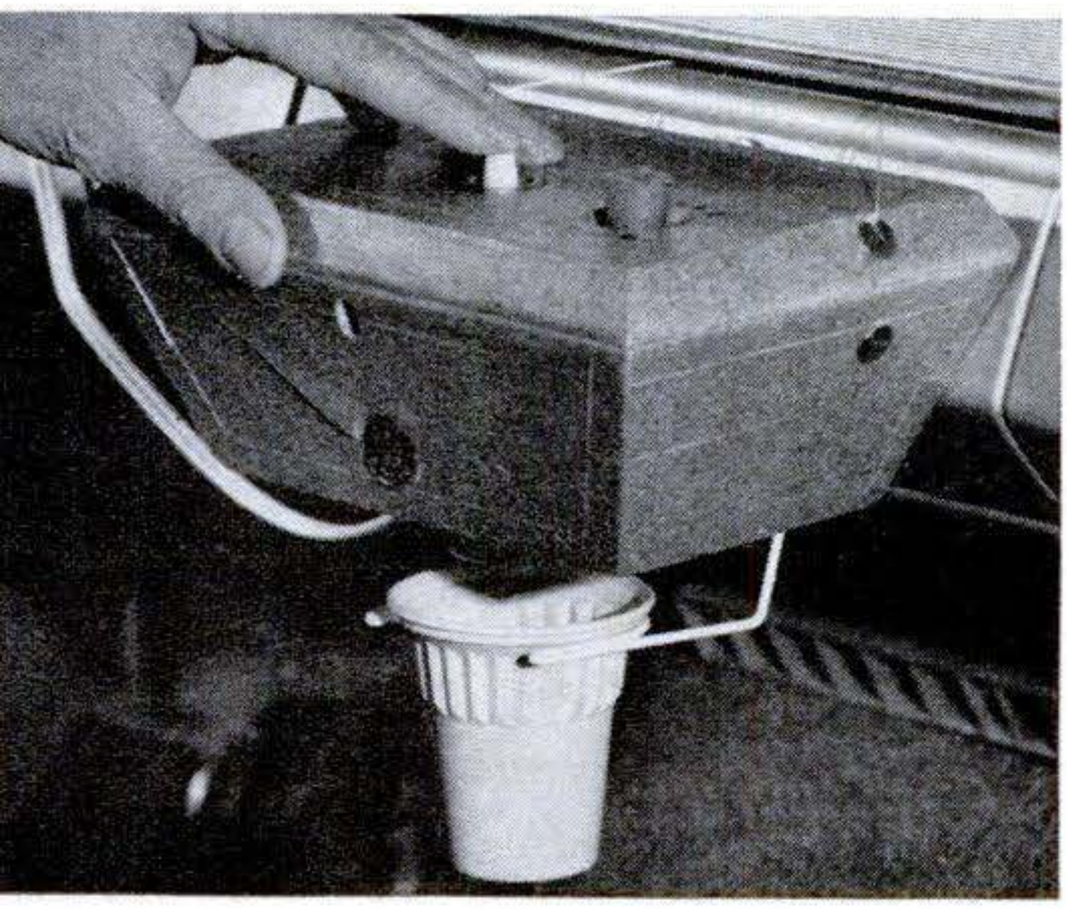


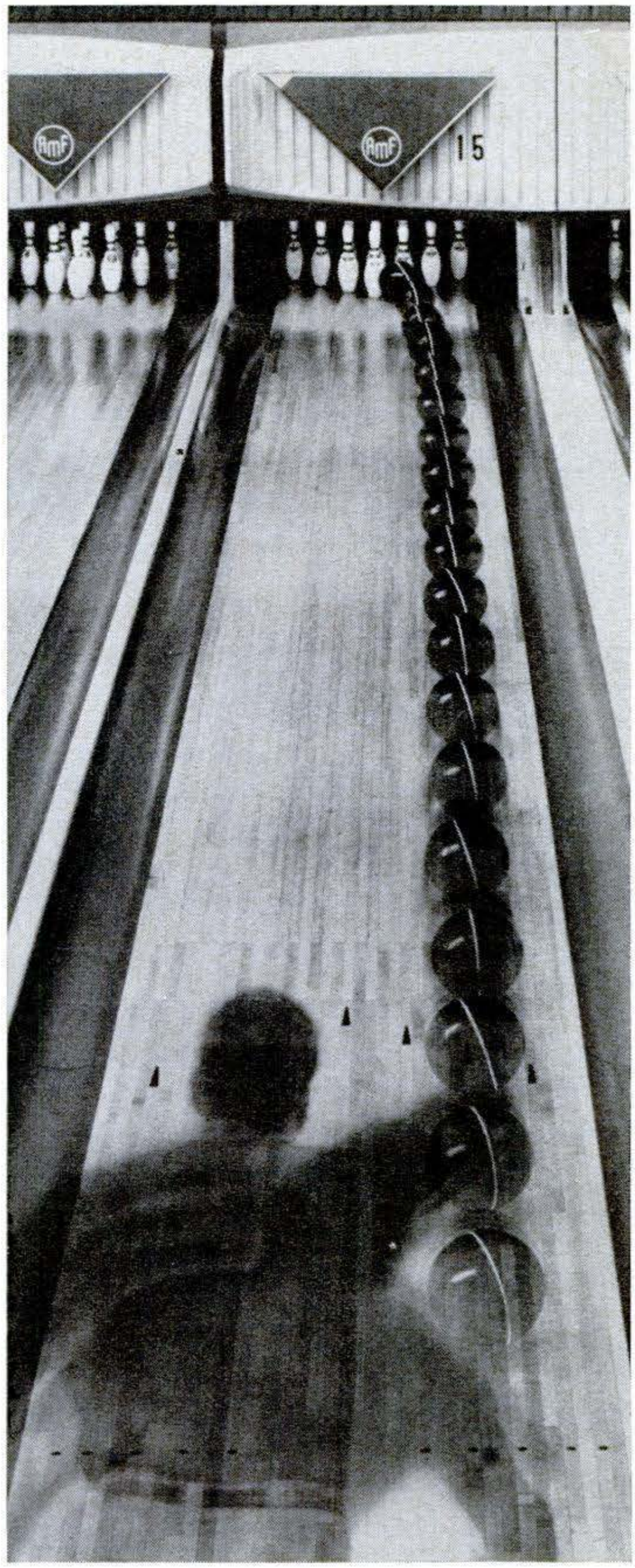
Bridge layer makes an instant span

This Centurion MK 5—a new British bridge layer—was demonstrated recently at the Fighting Vehicles Research and Development Center at Chertsey, England. The armored vehicle throws a 45-foot span across a river or gully in less than two minutes. A hand-laid center deck between the two main tracks enables the bridge to handle a full range of military vehicles.



Canteen makes coffee while you ride

You can take your coffee break right in the car during long trips with this new canteen. It plugs into the cigarette lighter and heats enough water for six cups of coffee or other beverages. The gadget, made of polystyrene, measures nine by six by five inches. The Car Canteen is sold by Empire Enterprises, Box 1244, Denver, Colo. 80201. Price, including cups: $12.95.



New bowling ball has red stripe

A striped ball, to help bowlers learn what their best strike delivery looks like as the ball speeds down the alley, has been introduced by AMF. By watching the pattern made by the stripe as the ball rolls toward the pins (as shown in the multiple-exposure photo above), you can develop a "success pattern" for your delivery, says the company. The Magic Circle balls cost $27.95.

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PS BOATING

THE EXPERTS TALK

Outboard, inboard, stern drive, jet? A quartet of experts help you choose what's best for you

By JIM ROE / *PS Boating Editor*

One of the delightful decisions every boatman must make is the choice of marine power. Though it sometimes takes a lot of thinking to choose between outboard, stern drive, inboard, or jet, you'll usually come out a winner. Some of the differences are economic, some related to engineering, and some simply a matter of personal preference. Here, four well-known marine-power experts share their thinking with you.

Richard M. Cors. An old hand in the marine power field, Dick Cors is now with Gale Products, a division of Outboard Marine, at Galesburg, Ill. This is the home of the OMC stern drive.

"Stern-drive units have created a great deal of interest and controversy" Cors says. "On the whole, they're gaining rapidly. Why?

"First of all, naval architects know that the best design is to have the propeller shaft running in a line parallel with the keel of the boat. In smaller inboard craft, this has been generally impossible.

"A standard shaft angle was developed which permits the shaft to come out of the bottom of the boat at 15 degrees. This tends to push the bow of the boat down. To overcome this, inboard boats are given a shallow angle of cleavage but are floored out very rapidly about a third of the way back from the bow. This type boat is work-

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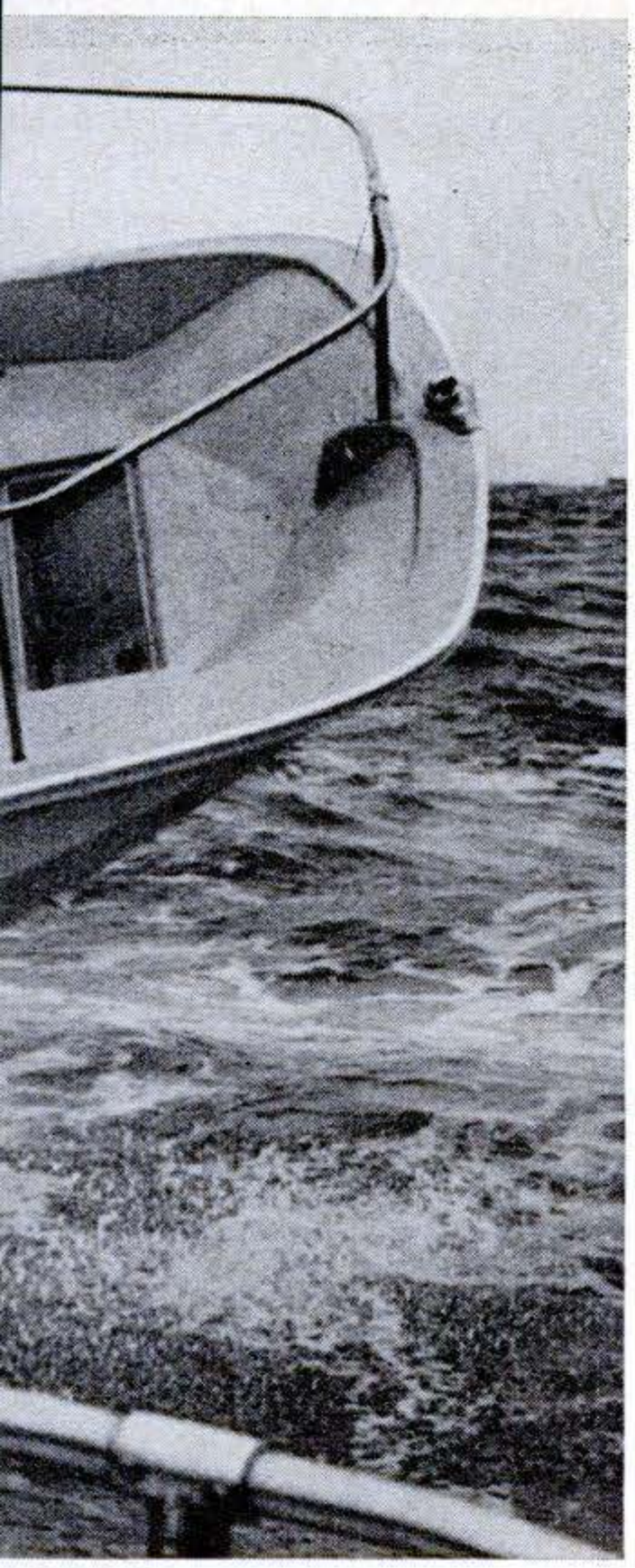
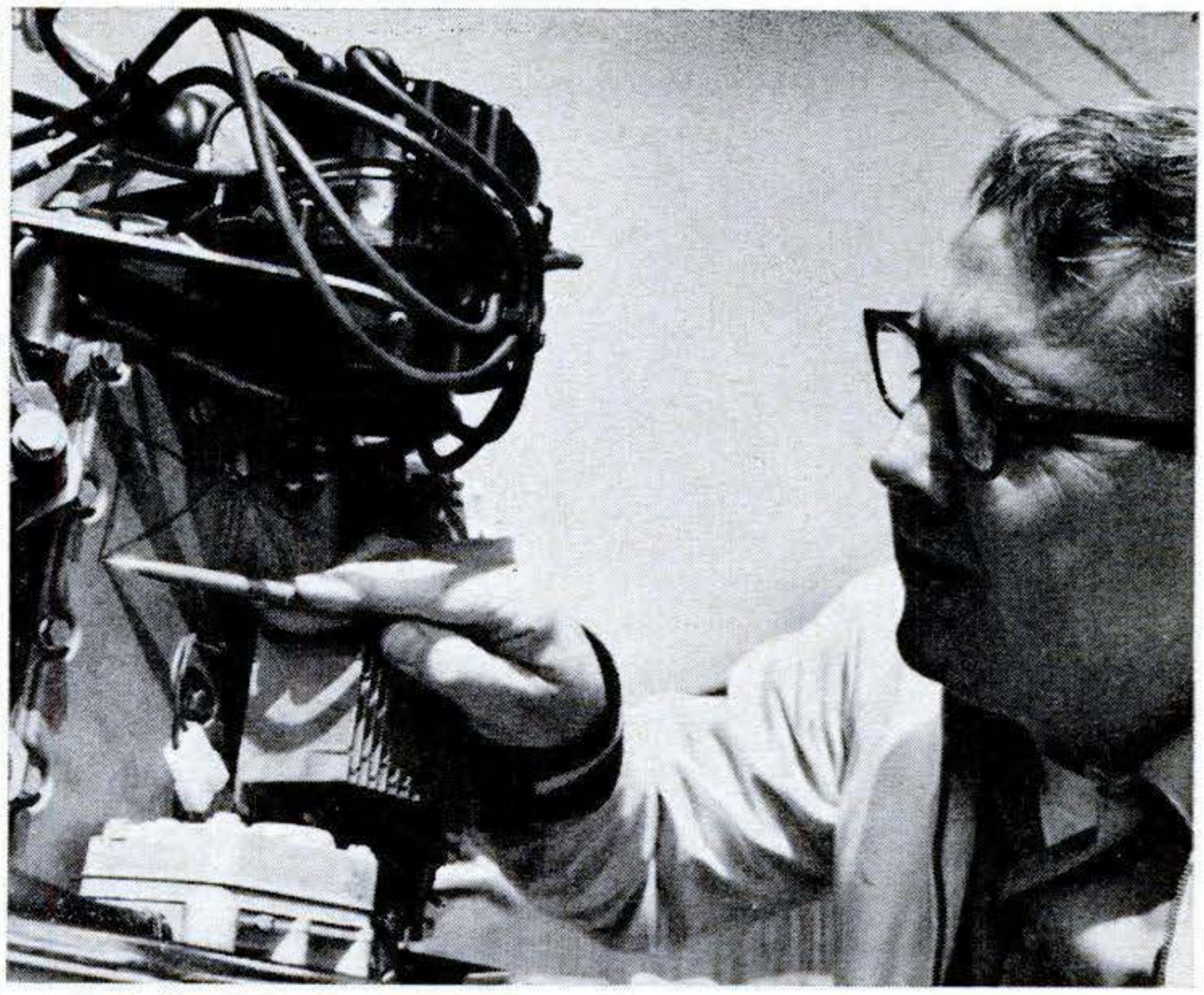
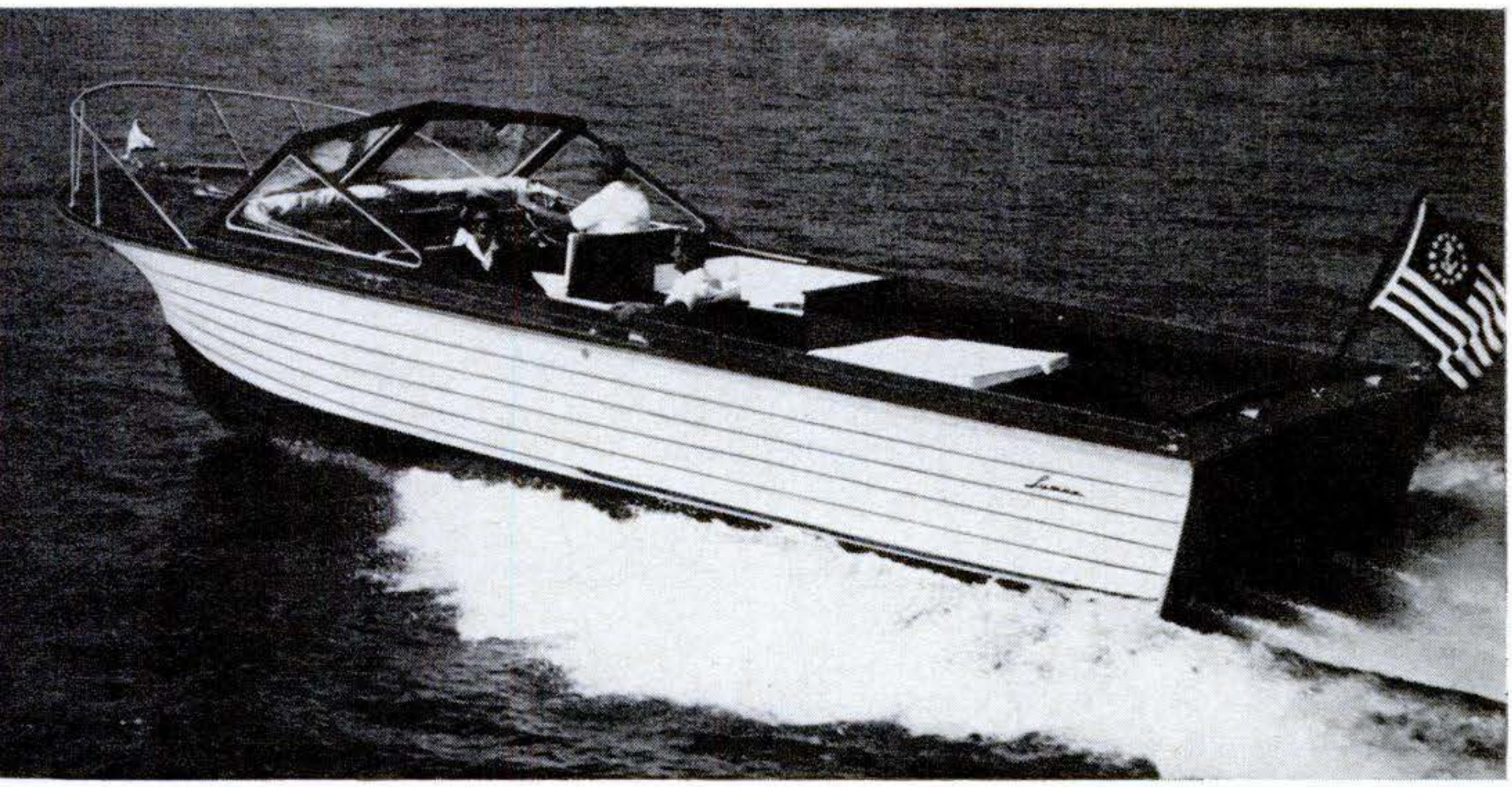




OUTBOARD **The indomitable outboard** goes anywhere. It comes in all sizes from a flyweight one hp. up to a mighty 110. Though most outboards are two-cycles, the one my son Jim and I are testing in the Pacific in the photo at left is four-cycle. Each year sees further refinement of outboard motors so that the power head puts out still more horsepower per pound of weight; powers of 125 hp. or more are forecast for the future. It's hard to beat an outboard for maneuverability, and for quick, exciting, go-anywhere response.

ABOUT MARINE POWER



INBOARD **The classic inboard runabout** has a charm all its own. The deep-throated roar of the speedboat appeals to generation after generation. Owners are quite willing to leave shallow, rocky waters to others with less vulnerable propellers.

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STERN DRIVE **A new favorite of boating America**—four-cycle engines, mounted singly or in multiples inboard, give all the convenience of an inboard boat. And the horsepower range of 60 up to 310 gives ideal flexibility.

ing one angle against another, and pays a penalty in performance.

"On the plus side, the conventional inboard has the convenience of having the engine handily located for maintenance or emergency repairs. Also, it is usually a dependable four-cycle engine.

"The location of this engine has been a problem, however. Most conventional inboard engines ended up in the middle of the cockpit area.

"When the outboard came along, it offered both advantages and disadvantages. Performance was very good because the outboard propeller could be kept on a parallel line with the keel. Also, the outboard can be run up on beaches, and can be taken into water of unknown depth.

"Stern drive is not a new invention, but a recently revised power application. It seems to be the ideal answer: inboard convenience with outboard versatility.

"It was soon discovered, however, that the conventional outboard hull was nose-heavy with stern drive. With inboards, on the other hand, the bow tends to ride high. So now most boat manufacturers have entered the field with a stern-drive hull.

"Interestingly enough, stern drive seems to bring out the best of the inboard's forward design and the outboard's aft design. The engine can be tucked clear in the stern, leaving much workable space forward.

"Since stern drive is adjustable, the propeller shaft can be kept running in a line parallel with the keel of the hull. Or it can be set at a slight negative or positive angle to compensate for the load. A stern-drive boat with a turning radius of 90 degrees is as maneuverable as an outboard."

Carl Kiekhaefer. Everybody with a boat knows of Carl. He *lives* marine power and has for more than 25 years. Here are excerpts from his recent replies to boatmen's questions:

Are stern drives replacing outboards?

"Hardly. The stern drive is opening up new markets. Over 50 percent of the stern

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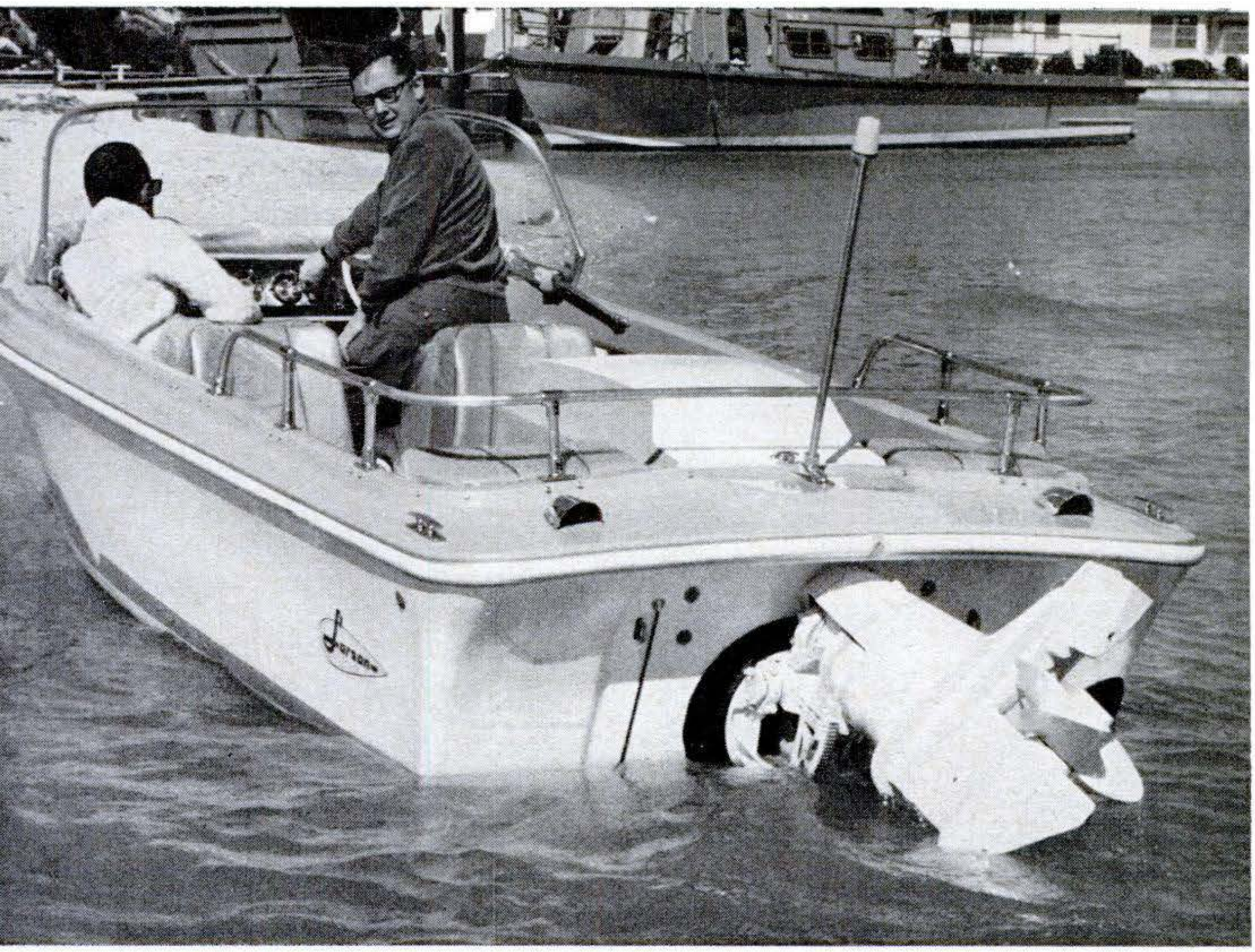

Stern drive offers outboard versatility. Power-tilt the unit up for beaching or exploring shallow-water areas. Use it just like an outboard for positive and quick maneuvering. Add sleek stern-drive hulls, good engine placement, and other features and you have a hot competitor in the new boating market.

drives sold by Kiekhaefer are bought by families with no trade-ins—new boaters. While our stern-drive sales have been increasing 50 percent or more each year for the past several years, sales of our large Mercury outboards have also increased.

Are the outboard manufacturers engaged in a horsepower race?

"Everybody says so. But it's not true. We have built higher horsepower engines from time to time because the market was ready for them. Most of you can recall when our 40 was the top-horsepower engine. If we had stayed with the 40, the fun and excitement, most of the skiing, most of the cruising that is done with outboards would be unknown today."

Is it true that the bigger the outboard motor the less economical it is to run?

"You've heard that one many times. Usually the idea is expressed like this: 'When you've got all those horses in the barn you've got to feed them.' This cliché is wrong.

"In tests made comparing the Merc 650 and the 950SS—a difference of 30 hp.—the fuel economy curves show that the Merc 650 has a slight advantage at lower speeds —up to about 28 m.p.h. From that point on the Merc 950SS enjoys an ever-increasing fuel-economy advantage. At 33 m.p.h. the smaller engine is logging 4.4 miles per gallon—the Merc 950SS almost 5.4. At 33.7 m.p.h., which represents full-throttle operation for the 65-horse, the 95 is still getting over 5.2 m.p.g. while the Merc 650 is getting just over four.

"The reason for the better performance on the big engine at higher speeds is simple: The smaller engine has to work harder to do the same job as the 95, so it uses more gas. Generally, a bigger engine operated at about ⅞ throttle will run more economically than a smaller motor going full bore."

Edward J. Reinelt, Manager of Engineering, Chrysler Boats and Outboards: "Of great significance are the trends which we

Continued

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JET A giant high-pressure water pump will make a boat do things you wouldn't believe. Pickup is fast, maneuverability at high speed is superb. Since nothing extends below the hull, she'll take you through shallows where no propeller-driven boat would dare venture.

see shaping up. One, for several reasons, is toward higher horsepower. The smaller, older motors are being replaced. There is a tendency among boat buyers to buy wider, larger boats which feature bow seating.

"I do not believe we have yet reached the maximum horsepower in outboard motors. I believe we may go to 125 hp. even with our present engine style. If the gas turbine comes in, we'll get 150 or 200 hp.

"Another definite trend of the outboard is to an increase in the power-to-weight ratio. True, high-horsepower outboards are heavy machines. But they produce more horsepower per pound than they used to.

"I think the inboard-outboard and the outboards are shaking down in their relationship to one another. In the 80 to 90 hp. and up, the inboard-outboard seems to be pulling away in popularity. Below this horsepower the outboard seems to have advantages and appeal to most boatmen. I see a great increase in the trend toward more compact, convenient outboards. Even the smallest are featuring electric starts."

Robbie Robinson. He believes in jets. His Berkeley jets have been used in a wide range of pleasure and special-purpose craft. Though jets at present make up only a small percentage of the total marine power units, Robinson points out ways boatmen are using jet drives successfully.

"We find that the most popular application for our 12J jet drive is in family pleasure boats that are used for skiing, wake surfing, cruising, fishing, skin diving.

"These are usually inboard planing hulls between 14 and 23 feet long. They use our jet drive fitted with the right size of impeller for their engine. The engine may be almost any marine or auto engine that produces 100 to 300 hp. at full throttle.

"Our customers report that our jet provides good performance and reliability. In hulls well suited to jet drive, the top speed is often better than that of a propeller drive; in hulls less compatible to jet drive the top speed may be two or three m.p.h. less than that of a propeller drive. Acceleration and ski-pulling performance are almost always better than propeller drive if the engine is 150 hp. or more.

"A typical family jet boat would be about 18 feet long, seven feet wide; would have monohedron running lines with 5-to-22-degree dead rise. It would be equipped with a Berkeley jet drive, 12 JA-A, package M, a 327-cu.-in. Chevy V-8 engine and would weigh about 1,800 pounds. Performance would be about 50 m.p.h. top speed, lightly loaded; 45 m.p.h. with nine people and equipment aboard. It would pull three adult slalom skiers to about 37 m.p.h. with six adults aboard.

"The next most popular application for our 12J jet drive is in the California-style ski-drag boats. These are used mainly for water skiing but they are also competing successfully in ¼ mile drag races on the West Coast. The power is usually a superstock automobile engine producing high power at 5,000 to 6,000 r.p.m. We know of quite a few Berkeley-equipped jet boats that can exceed 70 m.p.h." PS

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Sea Craft 19 Bow Rider ...CLEAN AND CLASSIC

Above water and below are lines to admire, and you have a choice of outboard or stern drive

By JIM ROE / *PS Boating Editor*

I first saw the Sea Craft 19 in the glare of a powerful arc spotlight at Tierra Verde Island, Florida.

I was interested at first sight. I was one of a group of boating editors attending the Kiekhaefer Corp. unveiling of its 1967 outboard and stern-drive power plants. These arrived offshore in front of us in rapid succession, propelling several-dozen different makes of boats. The Sea Craft 19-footer was instantly outstanding.

She sat the water easily. Her lines were clean. A slight downsweep from bow to stern gave her a look of action that was rakish, yet dignified.

Continued

SEA CRAFT 19′ SPECIFICATIONS

Centerline length	19′ 0″
Beam	7′ 4″
Weight (outboard model less motor)	**1,300 lb.**
(with 120-hp. MerCruiser stern drive)	**2,050 lb.**
Load capacity (outboard)	5 people or **1,500 lb.**
Power (outboard)	**150 hp. max.**
Fuel-tank capacity (stern drive)	**28 gal.**

Standard Equipment:
Stainless-steel International Rule navigation lights (stern light on retractable staff), anodized aluminum bow rail, deck hardware of stainless steel or chrome over brass, including mooring bit, towing eye, bow chocks; and two 4″ quarter cleats aft, single-lever clutch, and throttle controls. The stern drive has an instrument panel with tachometer, ammeter, engine-temperature gauge, oil-pressure gauge, ignition switch, fuel gauge, and power tilt.

Construction:
One-piece hull of fiberglass. Cockpit sole is fiberglass-covered plywood, integrated with hull and stringer system to form flotation tank.

Price:
Standard outboard model with 110-hp. Mercury 1100E motor, $3,395. Standard stern-drive boat with 110-hp. MerCruiser, $4,095; with 120-hp. MerCruiser and power tilt, $4,395. Batteries extra. FOB Miami.

Manufacturer:
Sea Craft, Inc., 6300 N.W. 7th Ave., Miami, Fla. 33166.

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This boat's rakish, yet dignified lines are interesting

I decided then and there I wanted to test-drive this boat.

So the very next day we headed her out into the Gulf of Mexico. Though the day was calm, the couple of miles of channel en route was choppy due to the wakes of two-dozen high-speed boats, which were constantly bouncing back from the steel-lined walls of the channel. I was pleased to see that the Sea Craft was a dry boat.

There are two large cockpit areas: one of them the normal cockpit aft of the windshield; the other a bow cockpit. The bow cockpit is handily reached through a walk-through area in the center of the windshield. It's designed to seat two passengers, with molded-in fiberglass seats.

The after cockpit can be fitted out in several ways: with two forward-facing seats and fishing chairs, or with two pairs of fore-and-aft convertible seats that fold down to form sunbathing lounges. Our test model was powered by a MerCruiser stern drive. The hull also can take an outboard. Its centerline is 19′ long, beam is 7′ 4″, maximum hull depth is 4′2″, and draft is 11″.

Bow cockpit is walked into through the center of the windshield, as seen at left. The stern-drive Sea Craft model is shown below.

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st sight; its deep-V hull performs with excellence

Storage space is generous. A forward locker provides space for anchor and line. A tray is molded in the instrument panel, and provides a handy spot for sunglasses and other personal gear. Bins are built into the side of the aft cockpit, providing ample storage space for skis, jackets, and scuba equipment.

While it was easy to see the Sea Craft's sleek above-water lines, we also wanted to test-out the design of her hull. The open waters of the Gulf provided a fine opportunity, and every speed maneuver or rapid turn indicated below-water excellence.

This hull was designed and patented by Carl Moesly, the Sea Craft's builder. It's a modified deep-V hull. When you view it from the stern, you are aware of a deep-V keel with what appeared to be three reverse lapstrake sections extending out on each side to the chine. These three sections are described by Moesly as constituting a "variable dead-rise bottom". Each has a different angle. The sections next to the keel have a high dead rise to better slice into the seas. This gives better water penetration, and cushions the ride in rough water. The middle section has a more moderate dead rise which helps medium-speed performance. The outer panel, next to the chine, is nearly flat. This gives the boat good stability at low speeds, as well as a high degree of lifting power while getting up on plane.

What Moesly has attempted to do is to capture the rough-water, high-speed advantages of the deep-V hull, and at the same time add some of the stability and slower-speed handling ability of a boat with a more flat bottom. Our experiences in the Gulf of Mexico and in the channels indicated he has achieved a high degree of success.

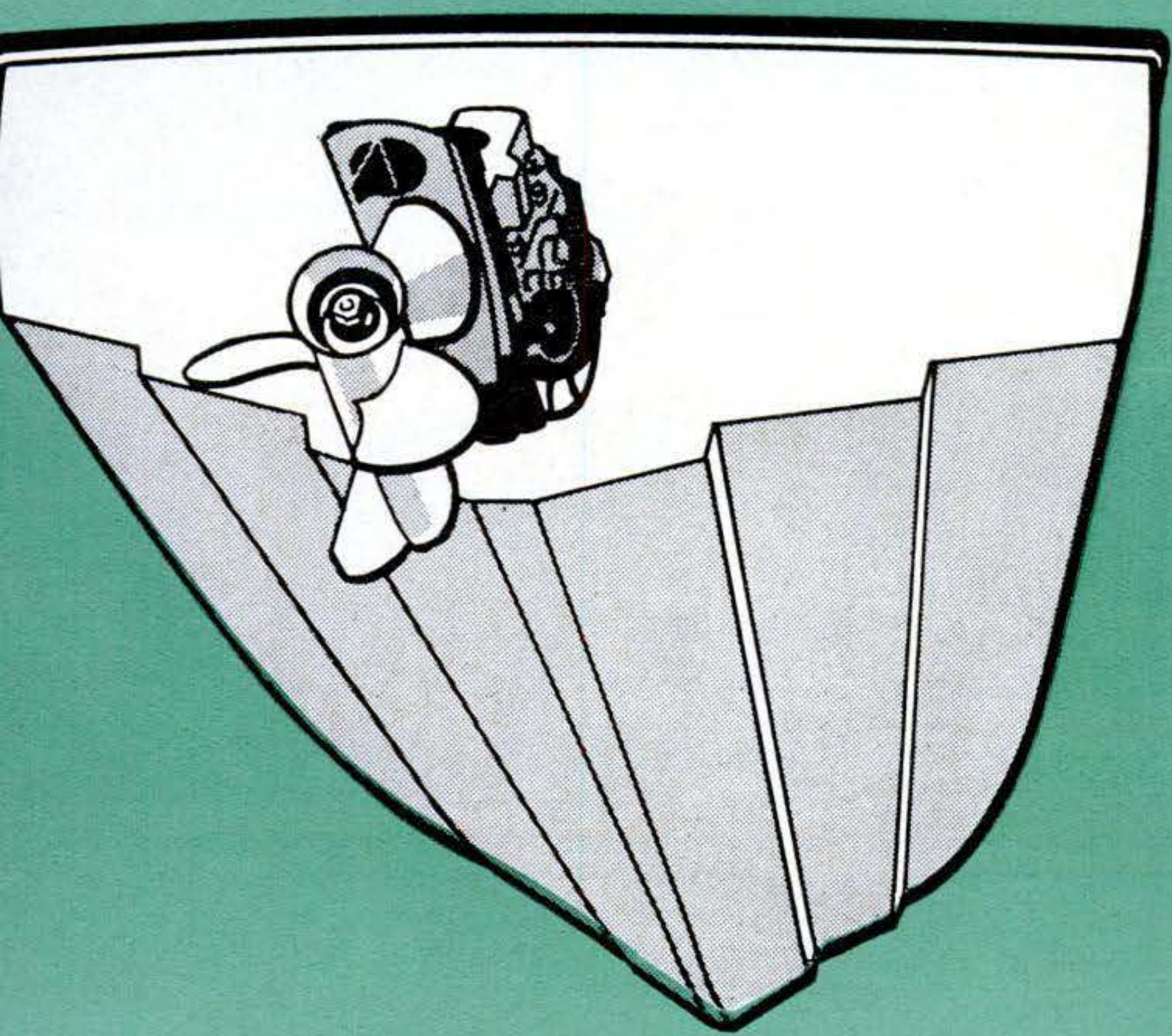
The hull is solidly constructed of fiberglass, with four cross-braced longitudinal stringers running the length of the boat.

Our test boat was powered by a MerCruiser 120-hp. motor. Maximum horsepower recommended by the engineers is 185.

In controlled speed tests made by Kiekhaefer engineers, the Sea Craft 19′ was put through her paces both as a sterndrive model and as an outboard. With the 120-hp. engine, she was clocked at 38.1 m.ph. with a one-person load. With four persons aboard, the speed was 35.2 m.p.h.

The Sea Craft 19′ sells for about $2,000 as an outboard model, not including the motor. With the 120-hp. MerCruiser she is in the $4,400 price range. The boat appears to have something for everyone: Fishermen will like its uncluttered aft cockpit, and its strategically placed bow cockpit area. For water skiers, it has plenty of room for stowage and rear cockpit activity. PS

Sea Craft's modified deep-V hull has three reverse lapstrake sections extending from each side of the keel to the chines. Each of the three bottom panels has a different angle. The high dead-rise sections next to the keel slice through the water and cushion the ride in rough seas. The moderate dead-rise middle sections provide good performance at medium speeds. The nearly flat outer panels stabilize the boat at low speeds, give lift for planing.



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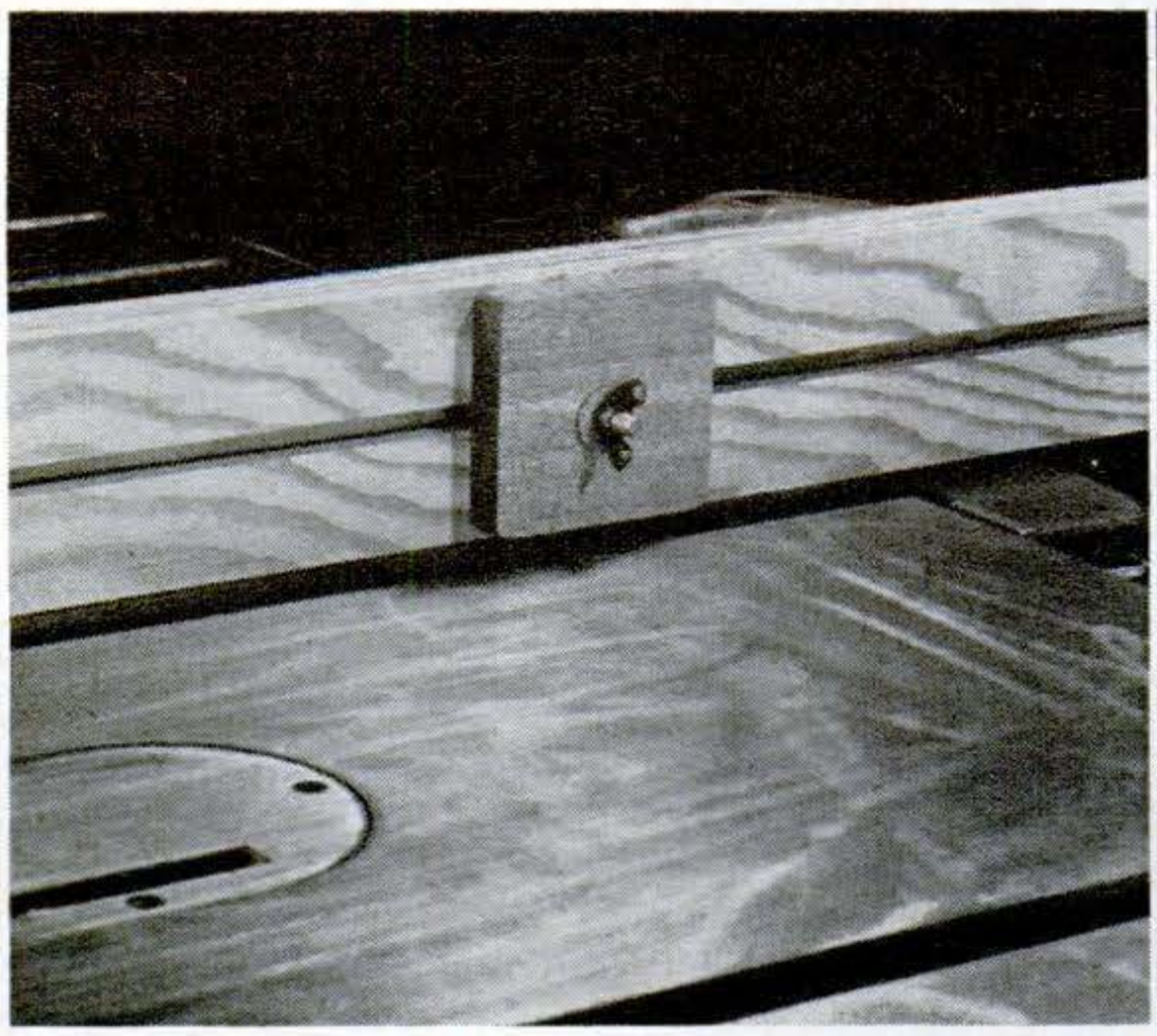
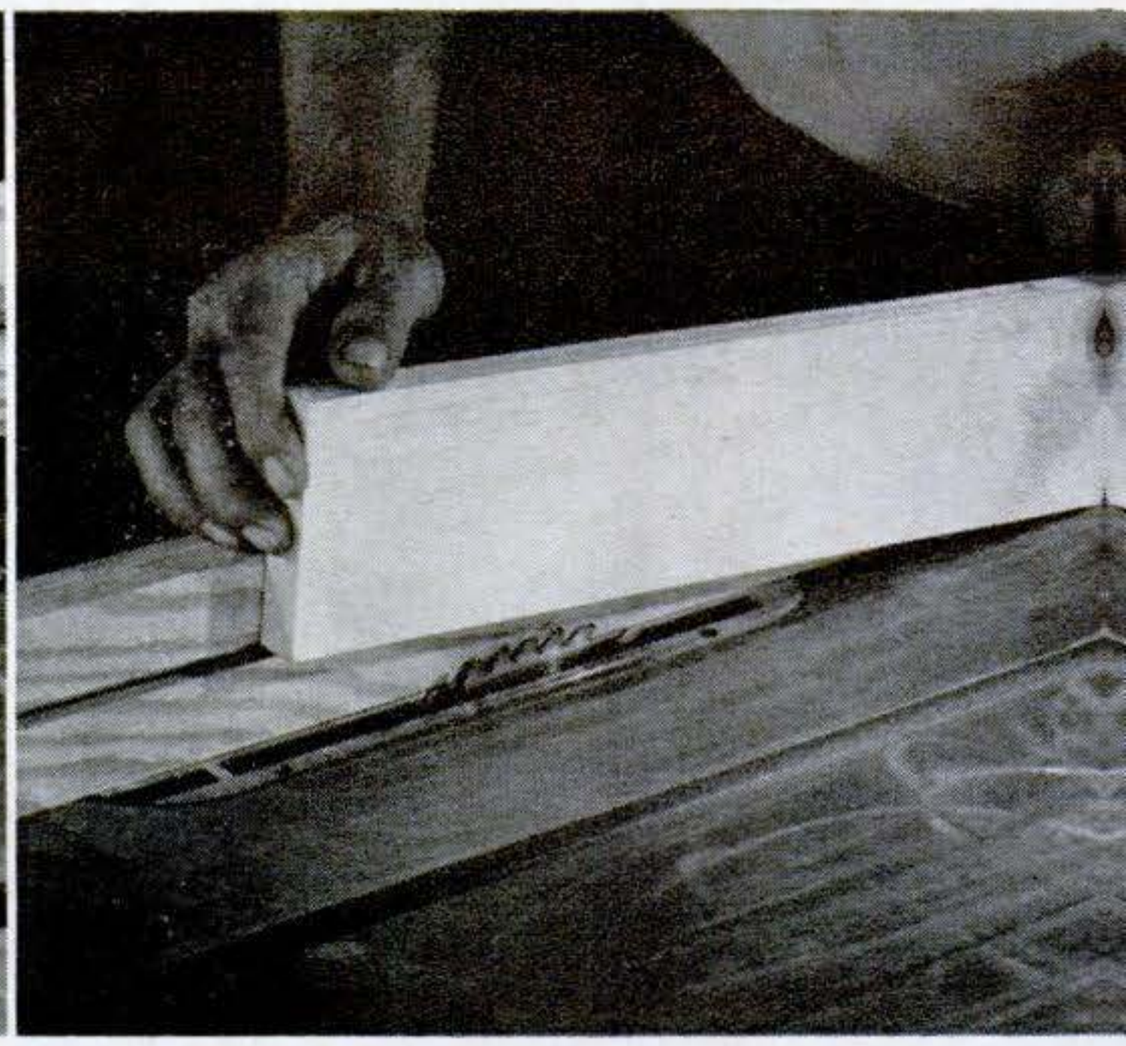
Add this accessory to your saw and you won't need clamps to control the length of a cut



Stops are hardwood blocks with keys that slide in a runner slot. Bolt and wingnut secure each stop. If your rip fence lacks holes for attaching the jig, drill two holes through it for #10 wood screws.



Typical use for jig is making groove for a blind spline. Hold work firmly against forward stop, then lower it slowly over the turning saw blade. Once work is seated on table, advance it to the back stop.

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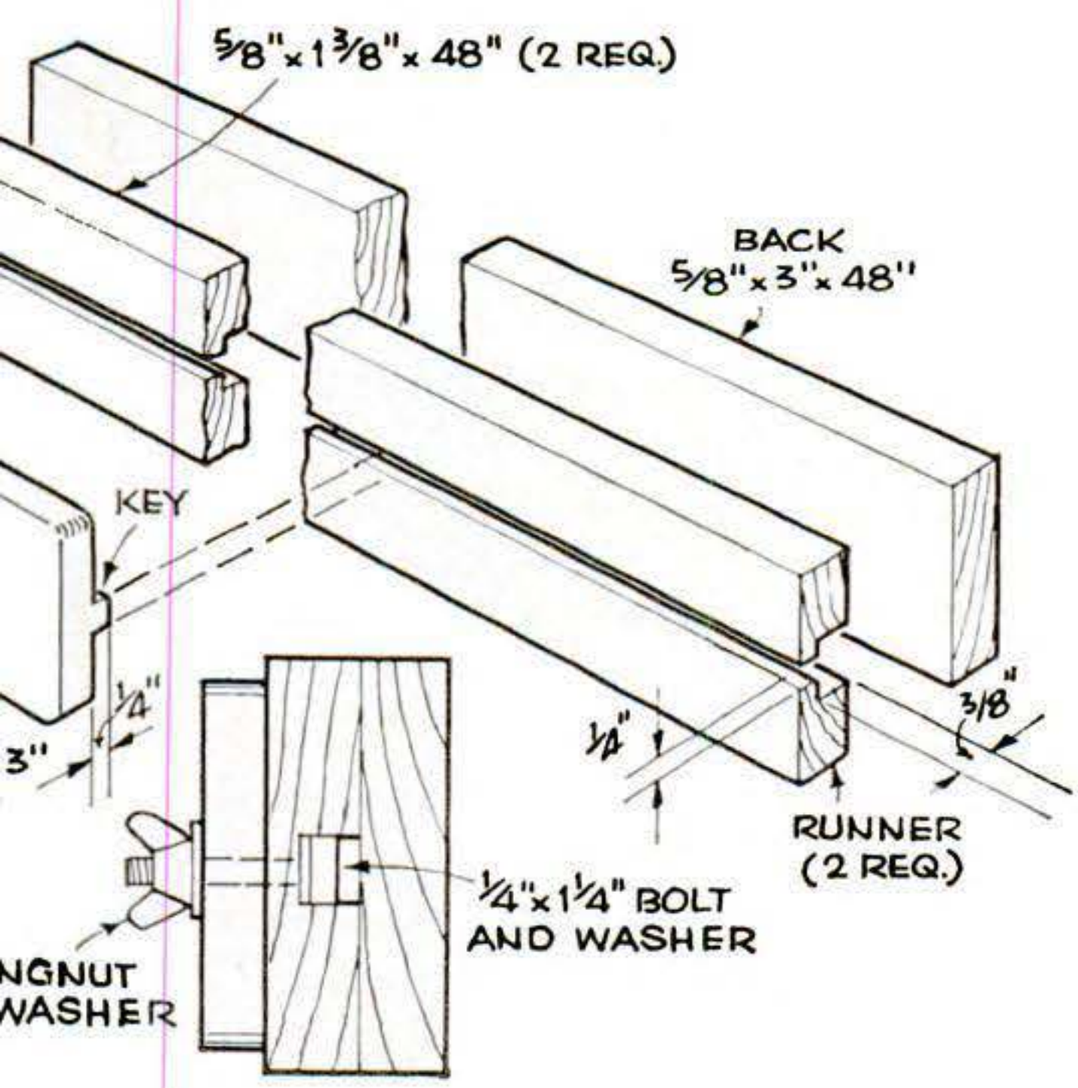
Rip-Fence Stop Jig

By R. J. De CRISTOFORO

This jig comes as close as possible to providing built-in rip-fence stops without a major design change on the fence itself. The stops are removed easily without detaching the runners. In effect, this means you'll have increased the length of your rip fence—a boon for some jobs, especially on small saws. Since the jig is attached with flathead wood screws that pass through holes in the fence, removing the whole thing is easy.

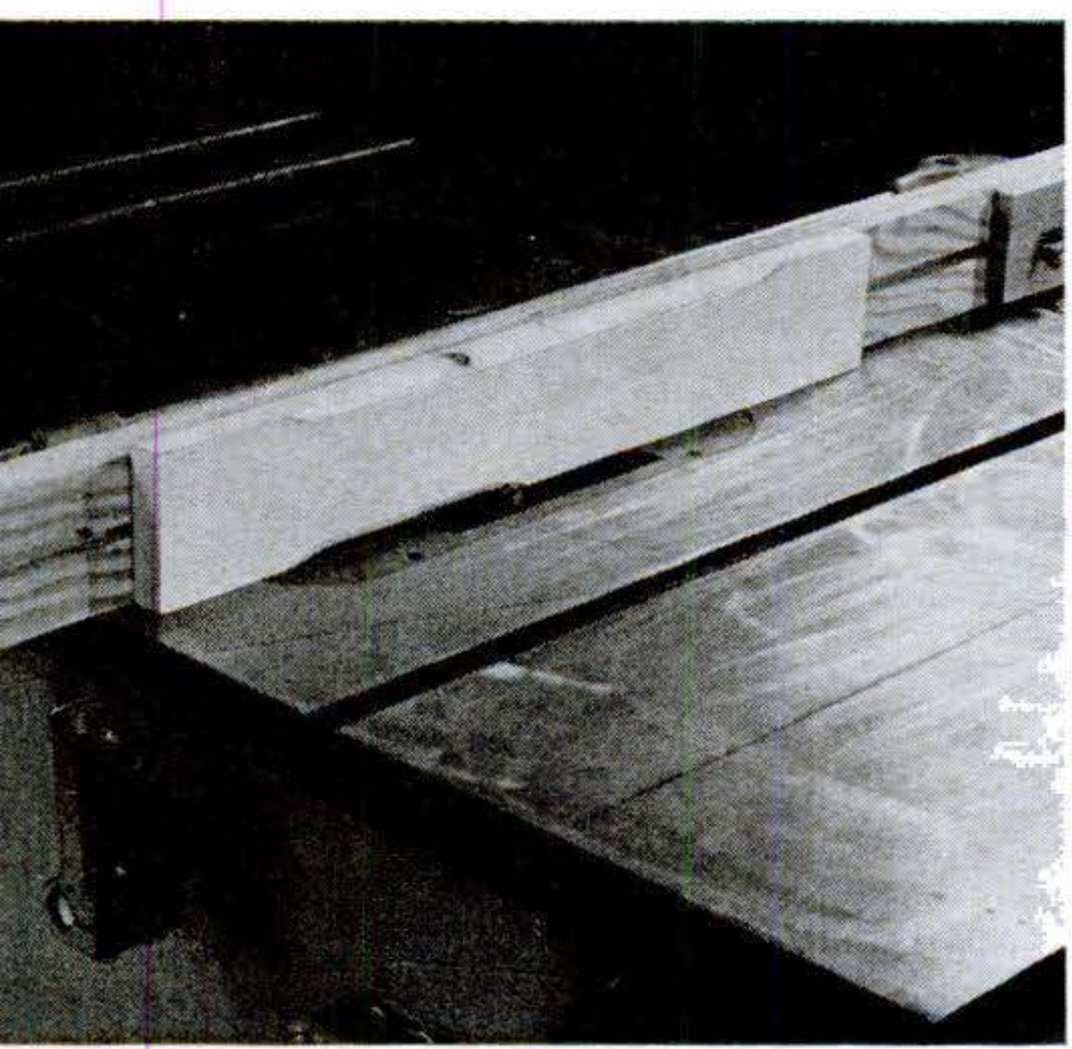


To make the runner assembly, first cut the back from a piece of ⅝" plywood. Ours is 48" long. You can shorten this a bit in relation to the size of your table, but reducing it too much would defeat the purpose.

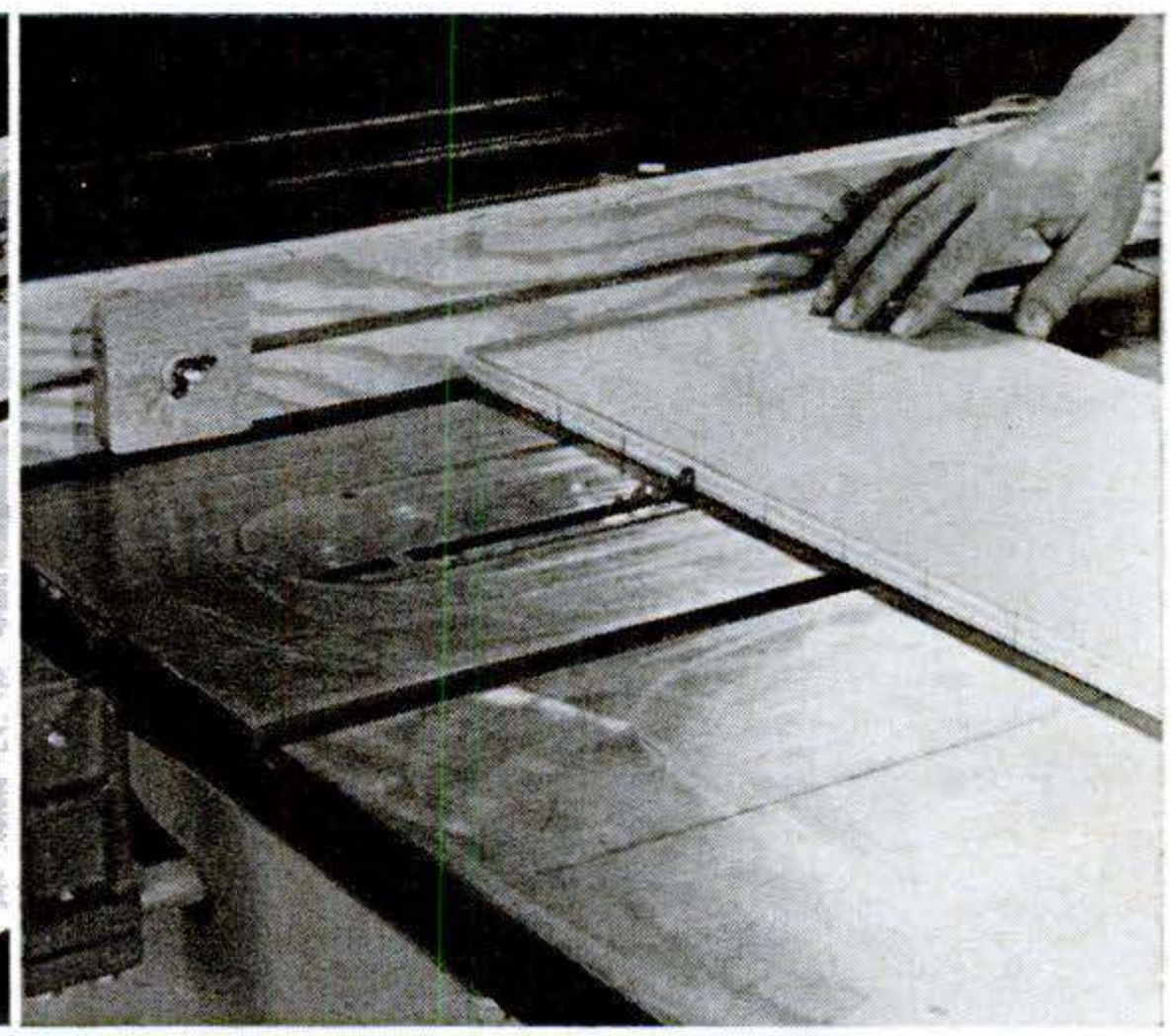
Runners are cut from the same material. If you produce two pieces 1⅜" wide and then form the rabbet on each shown in the drawing at left, you will automatically have the T-shaped slot when the runners are attached to the back. Do this with glue and small nails.

The stops are shaped from hardwood; if you wish to avoid the job of cutting the wide rabbets that leave the key, work with ½" stock and make the key as a separate part. Be sure that the stops slide easily in the runner slot. If necessary, you can redimension the rabbets in the runners to suit the head size of any ¼" bolt.

When you attach the jig to the fence, place a length of paper between the bottom edge of the jig and the table surface—to provide clearance so that the fence will still move easily as you work.



Stopped molding cuts also are easier. Here, the cut will be complete when the work has been fed far enough to hit the back stop. Work carefully when you're making the initial contact with the cutter.



A single stop block is all you need for some operations—for example, when limiting the length of slim grooves, as shown here. Use the same setup with a dado assembly, shaping stopped dadoes.

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YARD VACUUMS

By CHARLES E. RHINE
PHOTOS BY BILL MORRIS

Would you like to keep your yard, garden, sidewalk, driveway, garage, and shop as clean as your living room? Then throw away your rake and broom; you need a yard vacuum cleaner. It picks up leaves, twigs, paper, grass clippings, and other litter and packs them in a sack for easy hauling away.

With a really clean lawn you'll grow healthier, better-looking grass, turf experts say. Grass clippings and chopped leaves do not turn into a useful mulch, as many people think. They form a growth-inhibiting mat that keeps light waterings from reaching the soil and harbors fungi and insects that cause lawn failure.

Yard vacuums are man-sized machines that take the sweat out of man-sized cleaning jobs. They are powered by either gas or electricity, and have three, four, or more horsepower. You can also buy vacuums that attach to a garden tractor or a riding mower. If you have one of these, or plan to buy one, see if you can get a vacuum attachment for it. Most self-contained units cost $200 or more; the attachments much less.

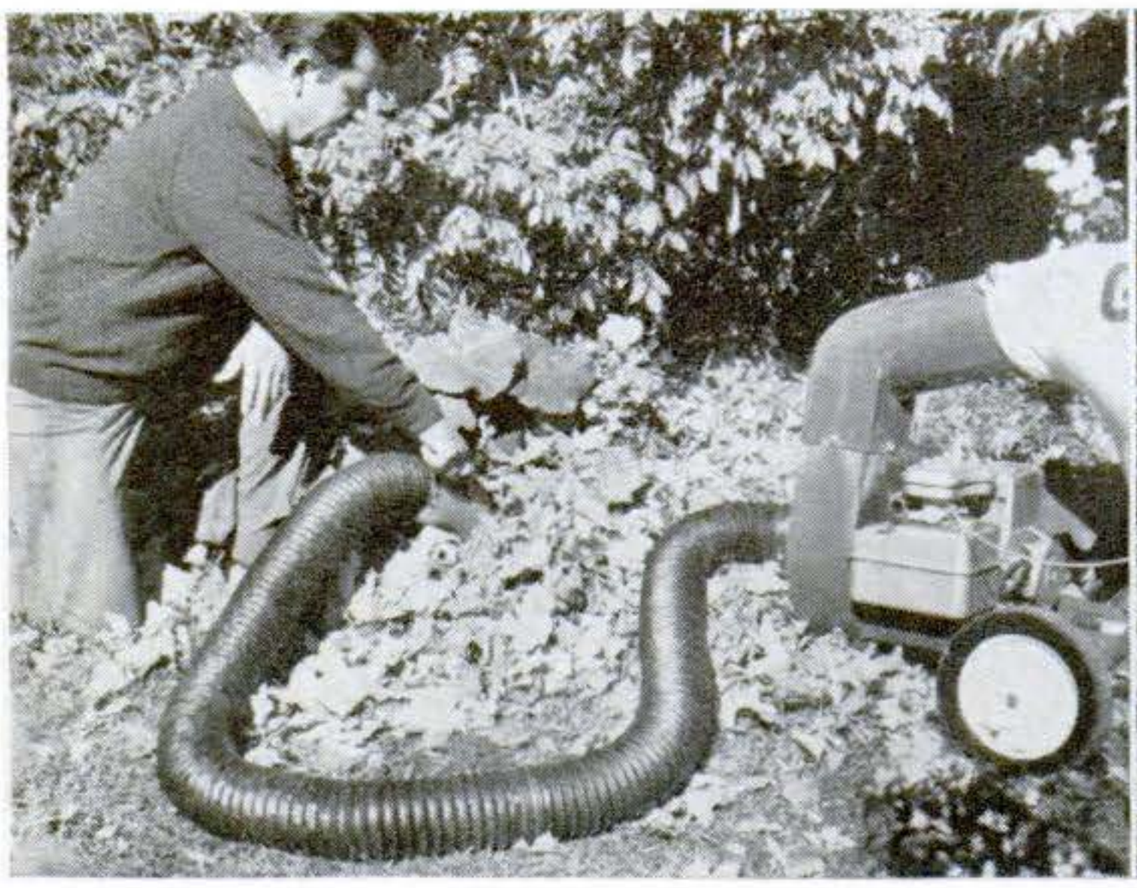
With accessories, a yard vacuum becomes a year-round tool for heavy-duty cleaning jobs around the home. Not only does it clean your yard—it'll also clean your garage, workshop, car, furnace, sidewalk, and driveway. A hefty hose you can attach to most models handles these tough cleaning jobs and lets you get at leaves and litter in hard-to-reach places under bushes, hedges, and in flower gardens.

When it comes to moving leaves, nothing beats a leaf blower. It puts out a hurricane-force blast of air that drives leaves and litter into a neat pile for burning or carrying away. Some yard vacuums come with blower attachments; or you can buy leaf blowers as separate units.

You can rent a blower to do a fall leaf-cleanup job. But if you want to make easy work of all your rough home-cleaning jobs, all year, consider buying a yard vacuum with all its attachments, including a blower.

A couple of hints on using a yard vacuum: Wait for a dry day to vacuum your lawn; damp litter clings to the ground and is hard to pick up. Don't try to vacuum the yard if the grass is high; mow, then clean up the clippings and leaves together. If your lawn is matted with a heavy accumulation of dead grass clippings, use a rake to work them loose, then vacuum.

A surprising bonus: The machine's impellers shred the leaves into a mulch you can use around shrubs, rose bushes, and in your garden. The chopped-up leaves are more compact, let you pack more debris in the bag before emptying. The bag unzips for easy dumping.



Hose attachment lets you vacuum hard-to-get-at places—under shrubs, behind plantings, and in gardens. A single wingnut lets you change attachments.

Blower attachment replaces collection bag to direct a hurricane-force blast of air at ground level to herd leaves into neat piles for removal or burning.

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New Year-Round Tool

Whopper-sized vacuum sucks up leaves with 200-m.p.h. air velocity and packs them in a large 8½-cubic-foot bag. It saves time and work. The vac shown is made by Giant-Vac, S. Willington, Conn.

Vacuum hose makes fast work of tough cleaning jobs around garage and shop. Gas-powered models should be used only in well-ventilated areas.

Cars, furnaces and other cleaning jobs normally tackled by the man of the house are best done with a man-sized vac, not the household vacuum.

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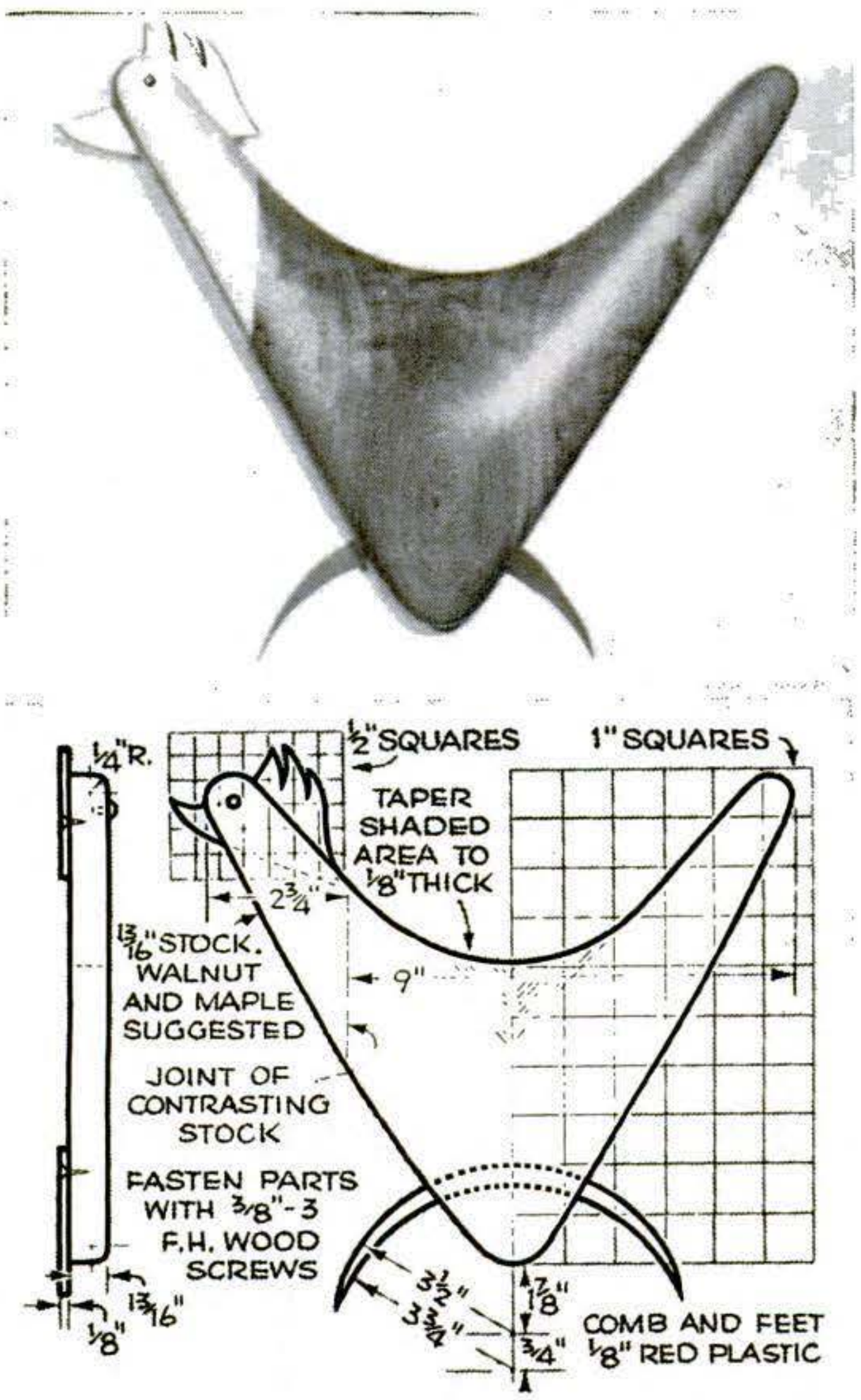
Shop Talk

By ROBERT P. STEVENSON

New book of simple and creative woodworking designs

For years, high-school woodworking students have been struggling through the same hackneyed and tired old projects. I have recently seen a new book that embodies an imaginative approach to this problem. The author, Milton W. Wille, is a young industrial-arts teacher in Wisconsin. The projects are simple, yet they're also appealing and fresh. Students should be pleased with them. And so, I think, should the rest of us.



You might wonder whether the title, *Art in Wood*, is appropriate for a collection of woodworking projects. Your answer will depend largely on how you define "art." The stylized chicken pictured in the accompanying illustration is one of the projects. I'd be happy to decorate a wall with a pair of them. And so, I suspect, will the parents whose high-school sons tote home projects inspired by the book.

Art in Wood ($3) is published by Bruce Publ. Co., 400 N. Broadway, Milwaukee, Wis. 53201.

Can you skip painting a new house?

Painting a new house is the style and custom nowadays. Some 300 years ago, pence-conscious English settlers along our Eastern seaboard had little use for such frippery as house paint. House painting did not become common until years later and, in New England, you still can see old houses that never have known paint weathered gray and, in the eyes of many, just about as attractive as a house can be.

Now, if you'd like to, you can get sound, scientific guidance in achieving the same result. You get it from a booklet that's free from the U.S. Forest Products Laboratory, Madison, Wis. Ask for *No. 0135, Wood Finishing: Weathering of Wood*. If you'd rather paint, as most people would, you can get help with that, too. Ask for another new booklet, *No. 0123, Wood Finishing: Painting Outside Surfaces*. The booklets recommend one important step that you should take in either case, whether you paint or not, and that is the liberal application of a water-repellent preservative. On unpainted wood, this will curb the growth of fungi that may cause unsightly dark splotches on the surface.

Look who's in the handsaw business now!

If you haven't paid attention lately to tool news, you may have missed the fact that Nicholson File Company now is making handsaws. And that's not all. This old and reliable file maker has also added circular-saw blades, backsaws, nests of saws, and pruners to its line.

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Storage Wall for a Family Room

This one is easy and cheap to build, and needs only a nine-inch strip of floor

By FRANK L. GREENWALD

Do you store your card tables, folding chairs, games, and other things you use for entertainment all around the house—in the attic, basement, and various closets? Why not build a special storage cabinet across the end of your family room, and have everything handy where you use it? Here's one that takes only a nine-inch strip of floor from the room's width or length.

Its removable front panels hide card tables and chairs. The center section has a foldout desk for doing household bookkeeping, or holding a projector. The cabinet top is handy for stacking magazines or serving snacks; the shelves for books.

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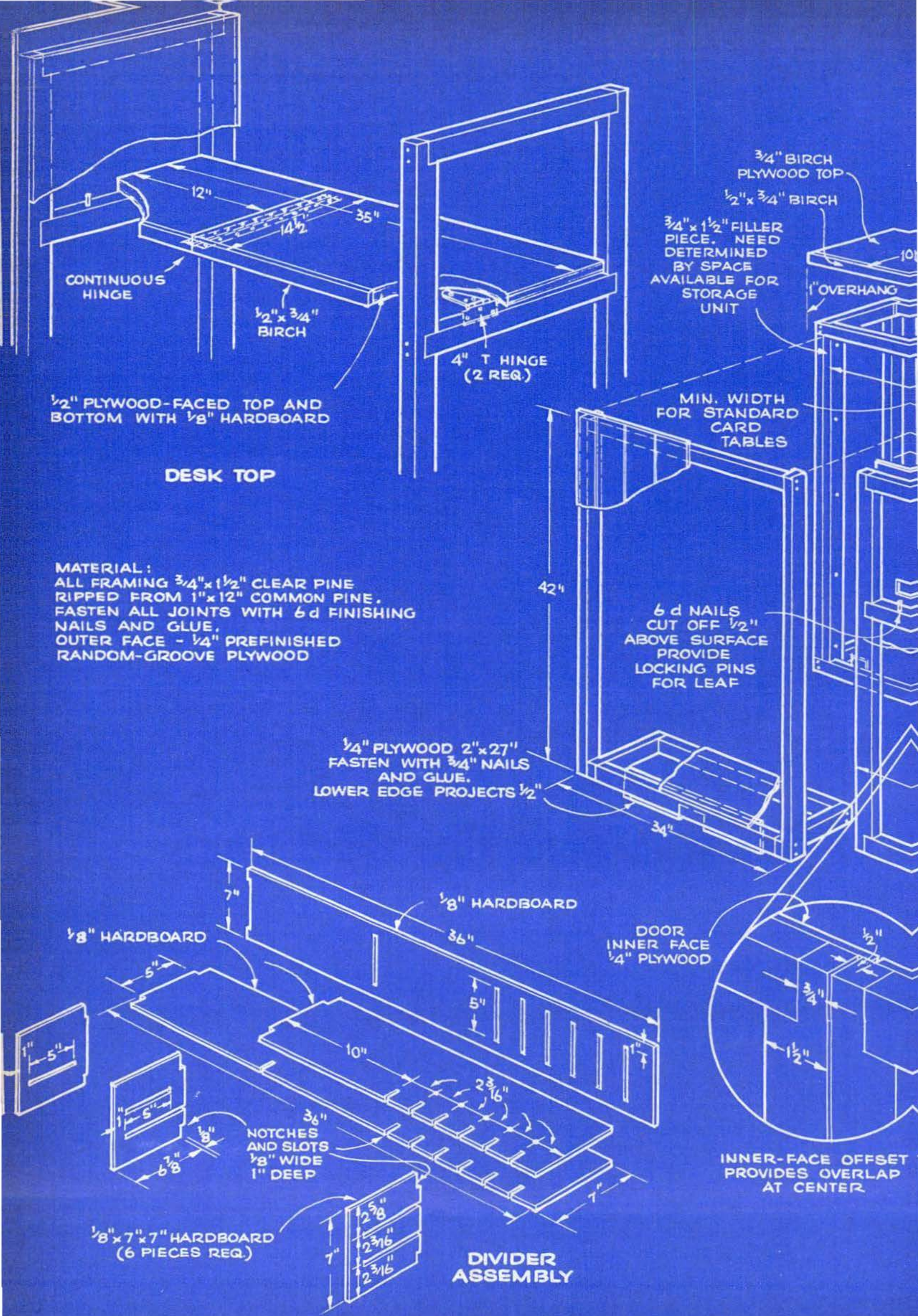
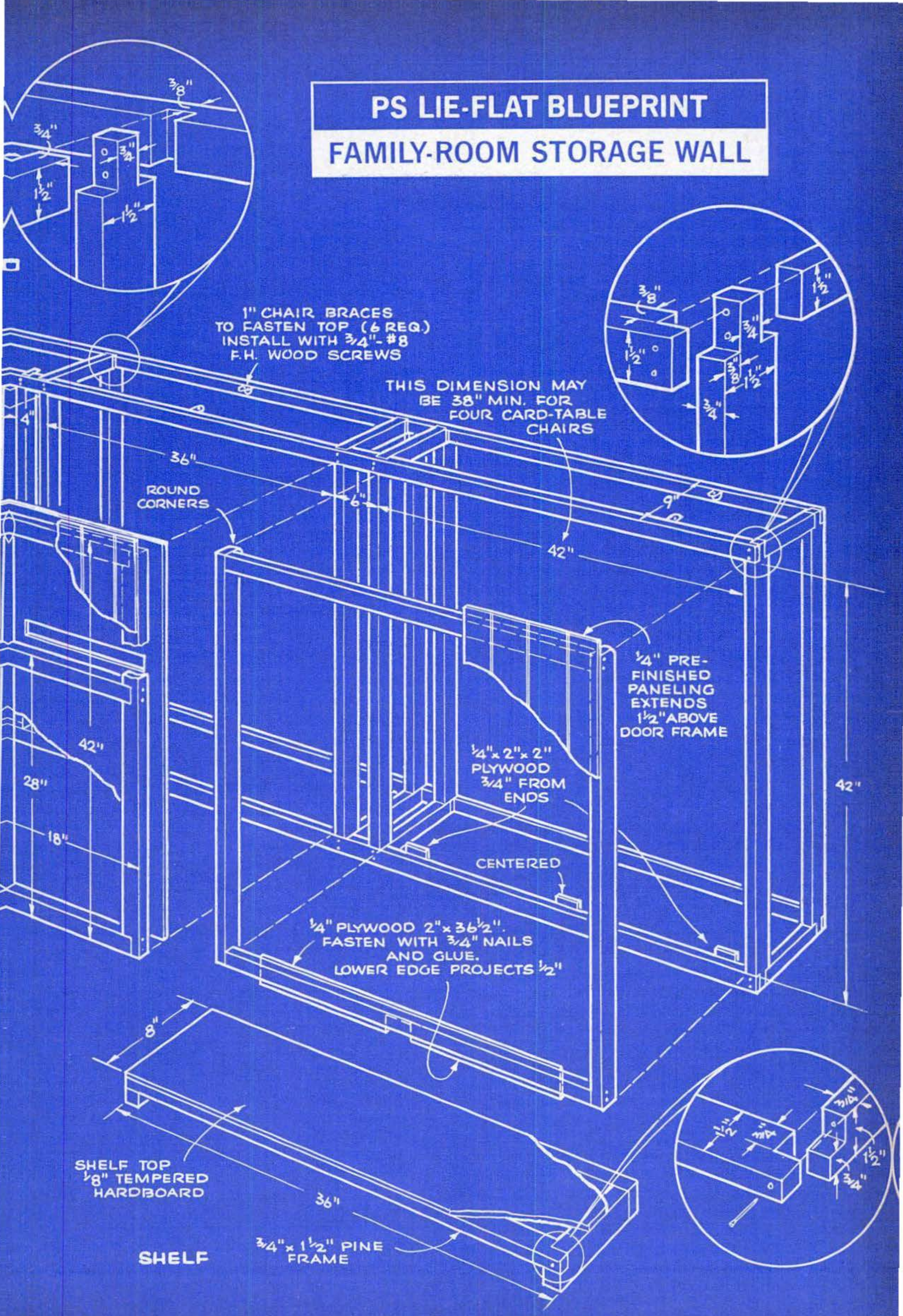
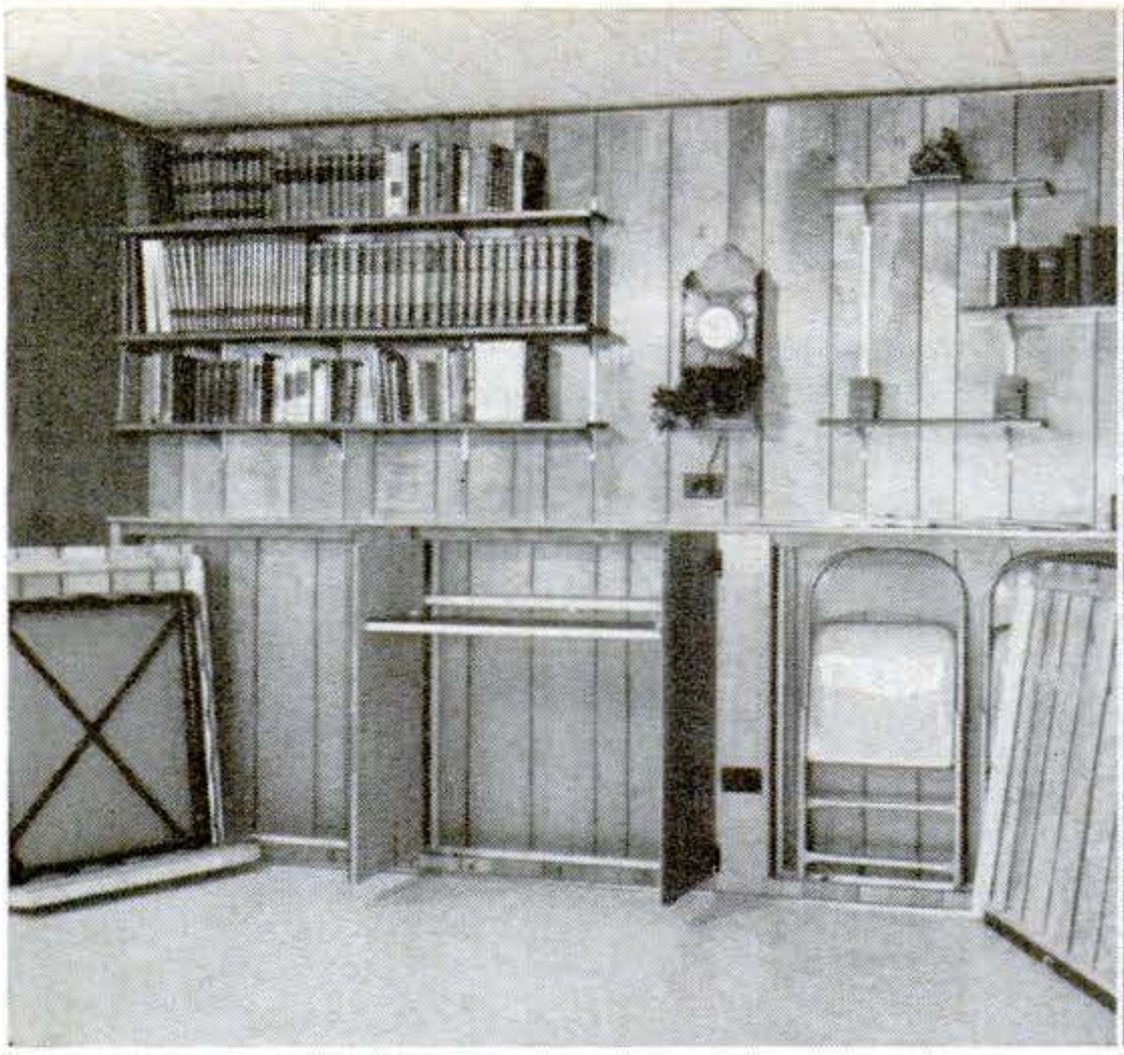

12"
35"
14½"
CONTINUOUS HINGE
½" x ¾" BIRCH
½" PLYWOOD-FACED TOP AND BOTTOM WITH ⅛" HARDBOARD
DESK TOP
4" T HINGE (2 REQ.)
¾" BIRCH PLYWOOD TOP
½" x ¾" BIRCH
¾" x 1½" FILLER PIECE. NEED DETERMINED BY SPACE AVAILABLE FOR STORAGE UNIT
1" OVERHANG
MIN. WIDTH FOR STANDARD CARD TABLES
42"
6 d NAILS CUT OFF ½" ABOVE SURFACE PROVIDE LOCKING PINS FOR LEAF
¼" PLYWOOD 2" x 27" FASTEN WITH ¾" NAILS AND GLUE. LOWER EDGE PROJECTS ½"
34"
MATERIAL:
ALL FRAMING ¾" x 1½" CLEAR PINE RIPPED FROM 1" x 12" COMMON PINE.
FASTEN ALL JOINTS WITH 6 d FINISHING NAILS AND GLUE.
OUTER FACE - ¼" PREFINISHED RANDOM-GROOVE PLYWOOD
7"
⅛" HARDBOARD
36"
⅛" HARDBOARD
5"
5"
10"
1"
2 3/16"
36"
NOTCHES AND SLOTS ⅛" WIDE 1" DEEP
⅛"
6⅞"
7"
⅛" x 7" x 7" HARDBOARD (6 PIECES REQ.)
2⅝"
2 3/16"
2 3/16"
DIVIDER ASSEMBLY
DOOR INNER FACE ¼" PLYWOOD
½"
¾"
1½"
INNER-FACE OFFSET PROVIDES OVERLAP AT CENTER

PS LIE-FLAT BLUEPRINT

FAMILY-ROOM STORAGE WALL





Lift-out doors open up to give you easy access to the chairs and tables you use for entertainment.

Folding desk sets up in seconds to give work space for household bookkeeping or letter writing.

The storage unit shown is located between a wall and a staircase. For different length walls, you can make the sections larger or smaller or add more cabinets. Minimum cabinet sizes for card tables and folding chairs are noted in the blueprint. Where one or both ends are exposed, cover the end frames with paneling, and cover the joints with corner bead.

Random-plank-type ¼″ Weldwood prefinished plywood was used, but prefinished hardboard paneling such as Masonite Royalcote would do. Plan the door joints to fall at the panel grooves wherever possible. The varying distances between panel grooves make possible many door widths.

The basic framing is ¾″-by-1½″ strips, ripped from one-by-twelve clear pine. Cut all uprights, crosspieces, and stringers first, and then assemble the bulkhead frames using the uprights and crosspieces. Put white glue on all joints, and blunt the points of the 6d finishing nails to avoid splitting. Fasten the stringer to the frames in the same way. Set frame against wall and level it before nailing it to the studs. A few nails through the rear stringers anchor it.

Build the door frames using the opening as a guide. Next, cut the plywood covering. Use a fine-tooth saw and cut in the center of the grooves. Size all panels to cover the top and bottom stringers. On the hinged doors, cut off the bottom 1½″ and fasten these pieces to the bottom stringer.

Attach the door panels to the door frames using ¾″ #18 brads and white glue. Complete the lift-out doors by adding the interlocking plywood pieces to the lower stringer and door frame. This aligns and hinges the door, yet lets you lift it out easily. Hold them in place with bullet catches in the upper edge.

The outer door panels for the desk section are attached and the doors hinged in place before the inner panels are put on. Twist the doors to fit the opening before attaching the inner panel.

Make the desk leaf 1½″ longer than the distance between the inner faces of the doors when they are at right angles to the front of the storage unit. Cut the leaf at the fold point before cutting it to length.

Fasten the two desk-leaf pieces with a continuous hinge; then fasten the long end to the right door with two 4″ T hinges. Drill two holes in the left end to slip over nails driven into the crosspiece.

Build the interior of the desk compartment to suit your needs. An easy-to-build pigeonhole divider is shown in the blueprint on the preceding two pages.

If you use prefinished paneling to build the storage wall, you're practically done. Just stain and finish the trim to match.

Finish up the job by putting shelves on the wall over the storage unit. An easy way to do this is to use Stanley Flaire aluminum shelf standards and brackets, and Decor prefinished shelves. The brackets come in five colors. PS

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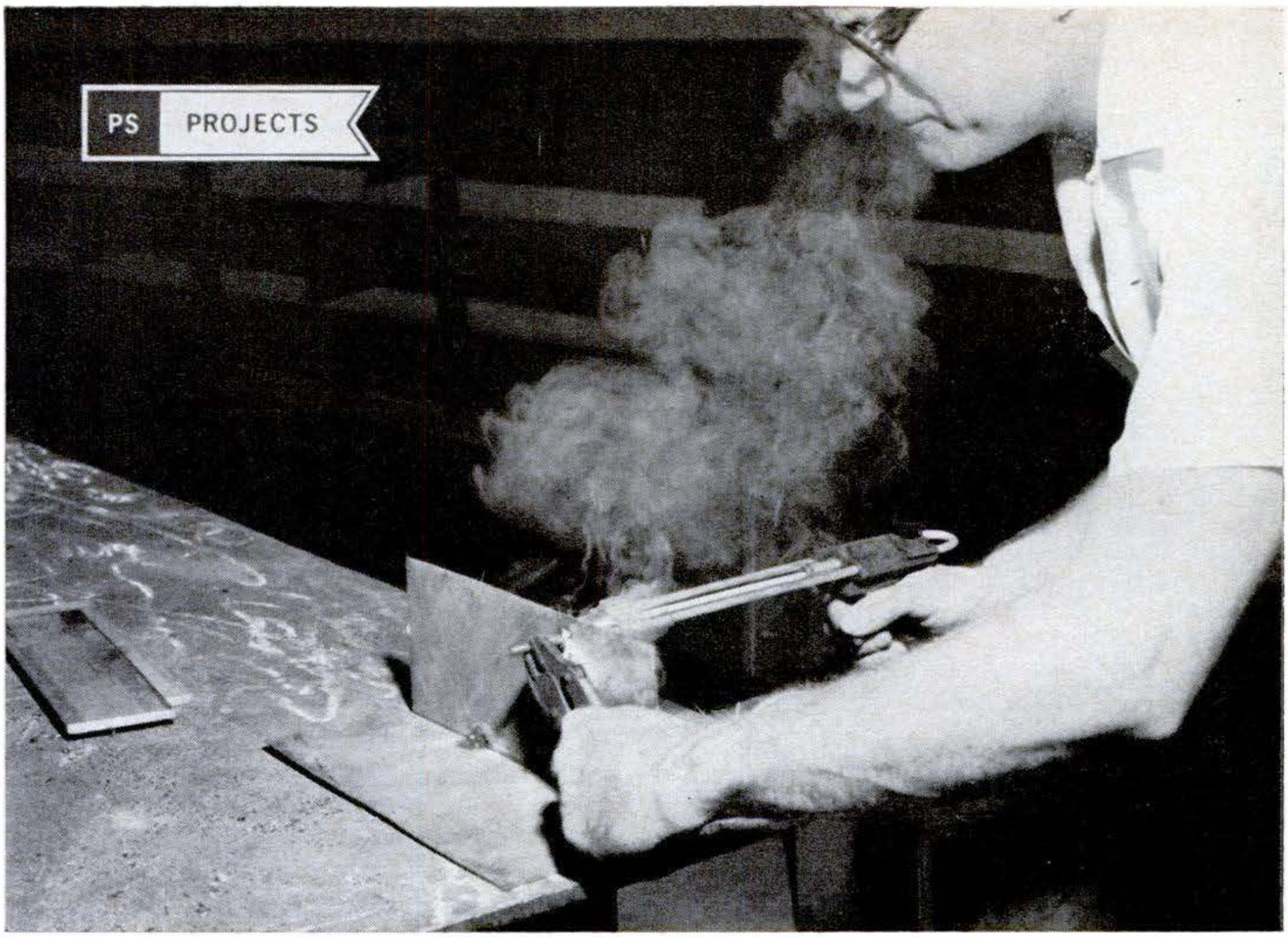

Gun nozzle confines the arc flash, and lets you do spot, plug, tack, stud, and button welds without a shield. As the electrode is used up, you loosen the clutch knob and move the frame back.

Build this handy ARC-WELDING GUN

By P.M. WILSON

If you've ever spent much time tacking up work with an arc welder, you know that half the job consists of raising your hood to check the work, and then lowering it again to weld. Here's an AC-DC welding gun that does away with all that hood handling. It lets you tack, plug, or spot-weld without using a hood.

How does it work? Basically it's an easy-to-grip electrode holder with a copper nozzle that covers the arcing area. Since the flash is confined, the danger from flying sparks is reduced, and the harsh glare from the arc can't reach your eyes. As a side benefit, the nozzle absorbs excess heat from the work to help prevent buckling and warping.

The gun is easy to make from parts available at hardware stores and welding shops. It uses 3/32″ iron-powder contact-type electrodes 9″ long. These are sold by Sears under the name Contact, by Montgomery Ward (Self-Strike), GE (Strike-Easy), Westinghouse (Zip-24), and others.

It's easy to use, too. Put an electrode in the gun with the tip about ¼″ back of the front edge of the nozzle. Hook up your power cable to the electrode holder of the welding machine (at least a 75-amp model),

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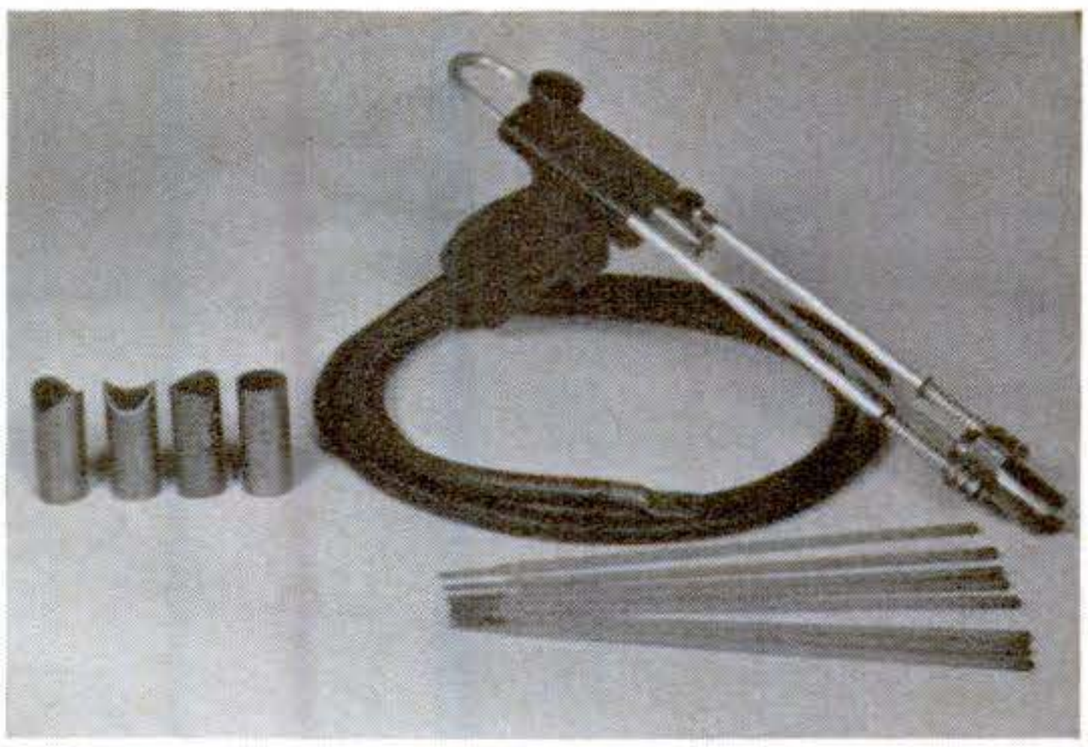
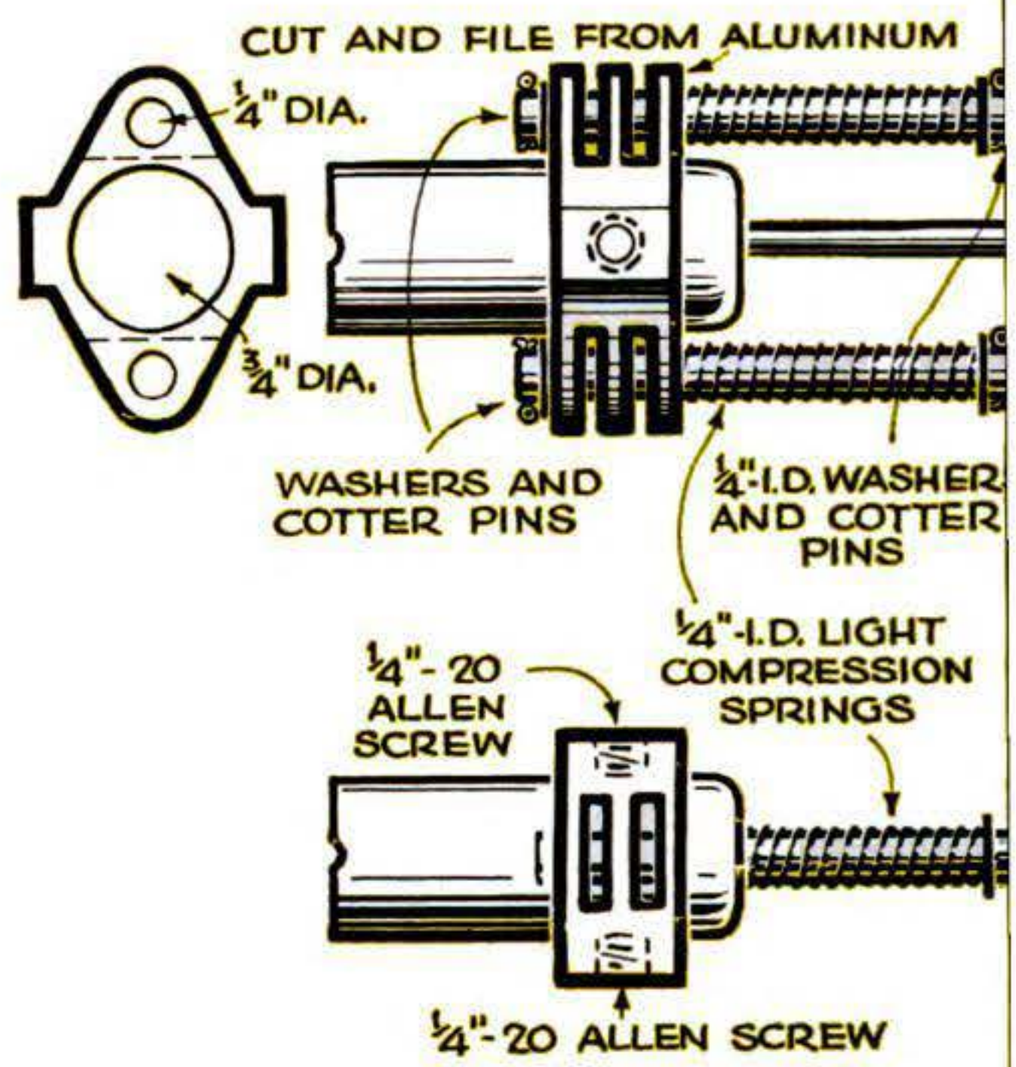
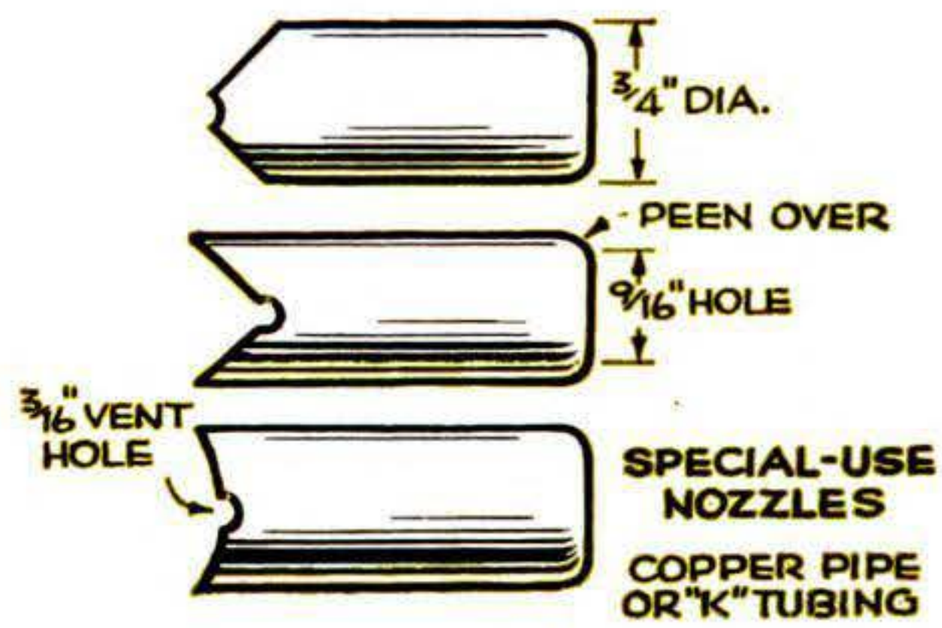


The gun is easily built from standard hardware-store parts, as shown in the drawing at right. Special nozzles shaped to fit the work (above, left) are made out of copper tubing. The gun uses powdered-iron contact electrodes (foreground in photo) available from most welding suppliers.





and make sure the ground is firmly attached for a good circuit. Clamp two scraps of sheet metal together to practice on. Start the welder and set it to about 60 amps. Snug down on the clutch knob to hold the sliding member firmly in place.

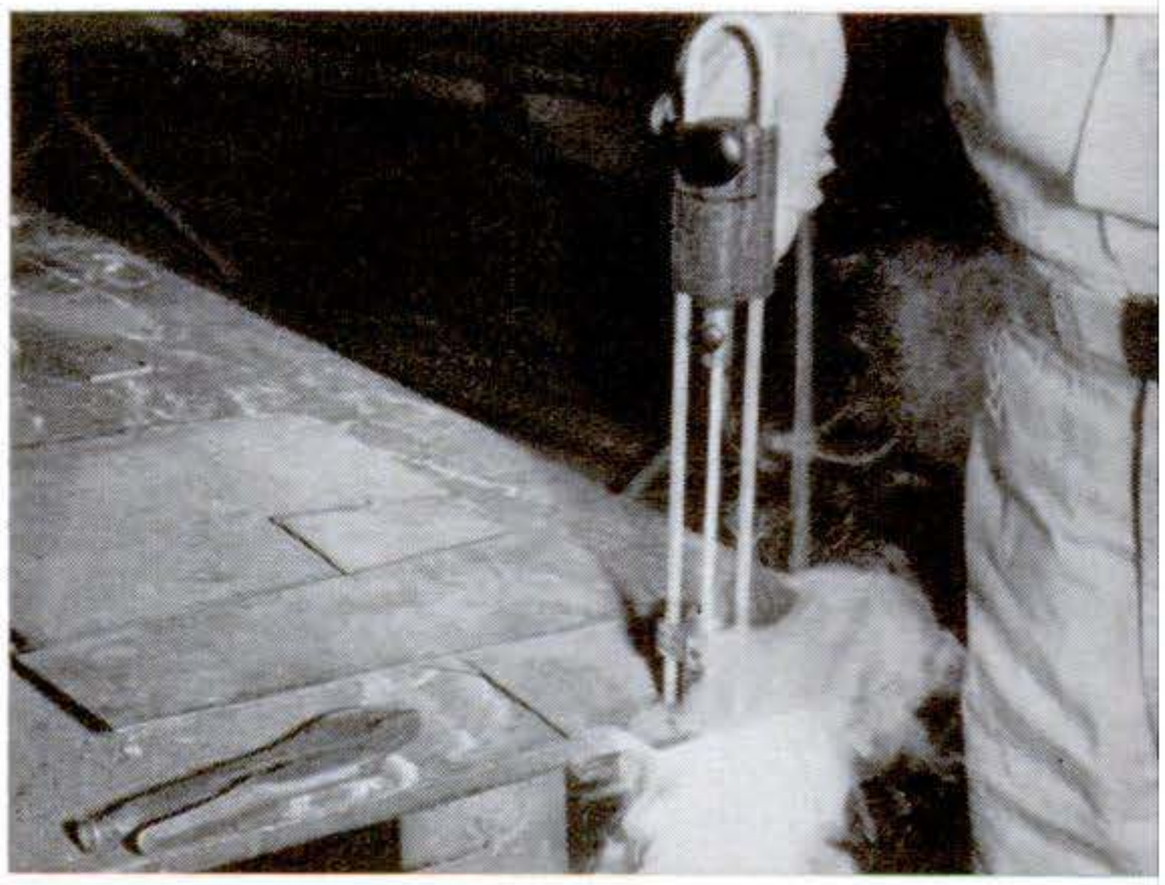
Now gently press the nozzle into the work until contact is made. There should be a *pffft*, and the contact will break. The duration of the contact determines the type of weld. Momentary contact makes a spot weld. Longer contact makes a plug by burning all the way through the work to form a hole, and then welding the hole back up as you retract the gun. As the electrode gets shorter from use, loosen up on the clutch knob and move the sliding member back, keeping the nozzle about ¼" in front of the electrode tip.

Higher amperage lets you weld studs or screws to sheet metal. On thin work just hold the stud in place on one side of the work, weld through from the other side, and ease off slowly on the gun. On thicker metal you may have to drill through the work, insert the stud halfway into the hole, and then proceed to weld.

Amp settings you use depend on the type of work you do. Light work is best done around 60 amps. Heavier metal or welding studs need more power. Practice a while to determine the best settings.

The iron-powder electrodes used in the gun are not inclined to stick, but if you jab them down too quickly onto the work they may. If this happens, disconnect the power cable from the electrode holder, not from the gun, and work the rod loose.

You can make accessory nozzles to fit the contours of special work. The three most commonly used accessory nozzles are shown in the drawing. These let you work on curved metal, and inside or outside right



Spot-welding two pieces of sheet metal for subsequent finishing with normal welding techniques is one of the basic uses of the arc-welding gun.

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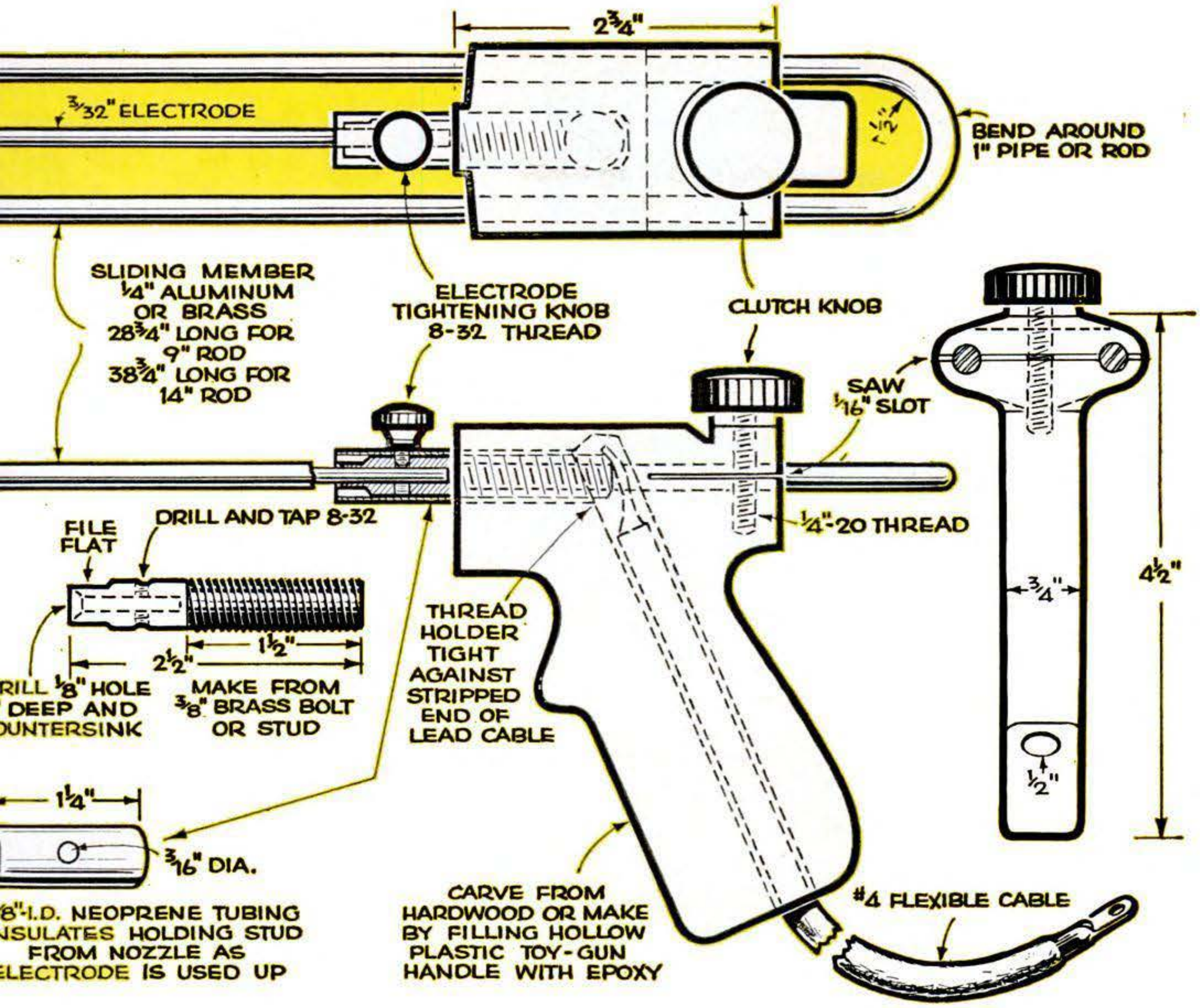
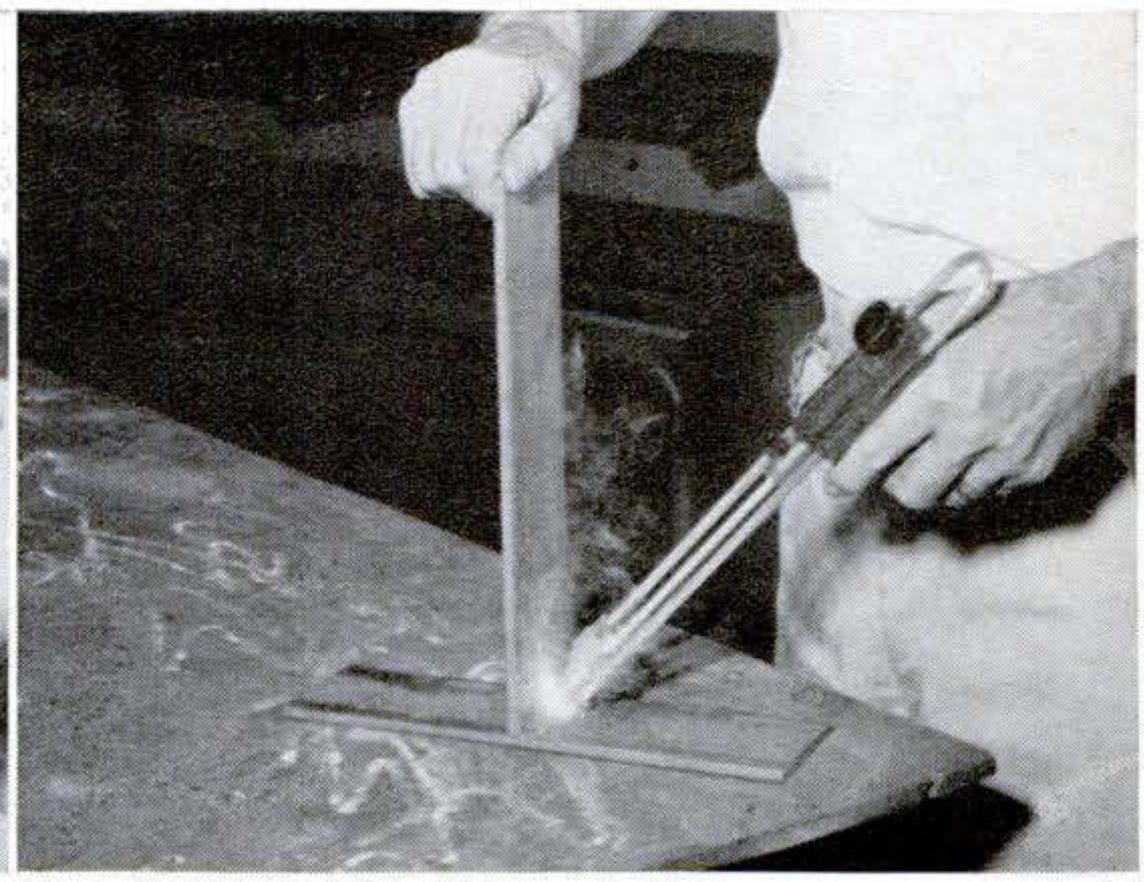


angles. Be sure to file vent holes to allow hot gases and smoke to escape.

Here are some troubles you might run into: If the rod sticks or bends, it's caused by pushing down too quickly on the handle, by using too low amperage, or by pulling back too fast on the electrode. If the arc follows up the nozzle, you're using too much amperage, the nozzle is off center, or the nozzle is dirty. PS

Tack-welding an outside right-angle joint is done with a nozzle shaped to fit the work. It confines the flash, and eliminates need for a shield.



Tacking inside corners is one of the many jobs the welding gun lets you do. For different types of work, nozzles are quickly changed with an Allen wrench.

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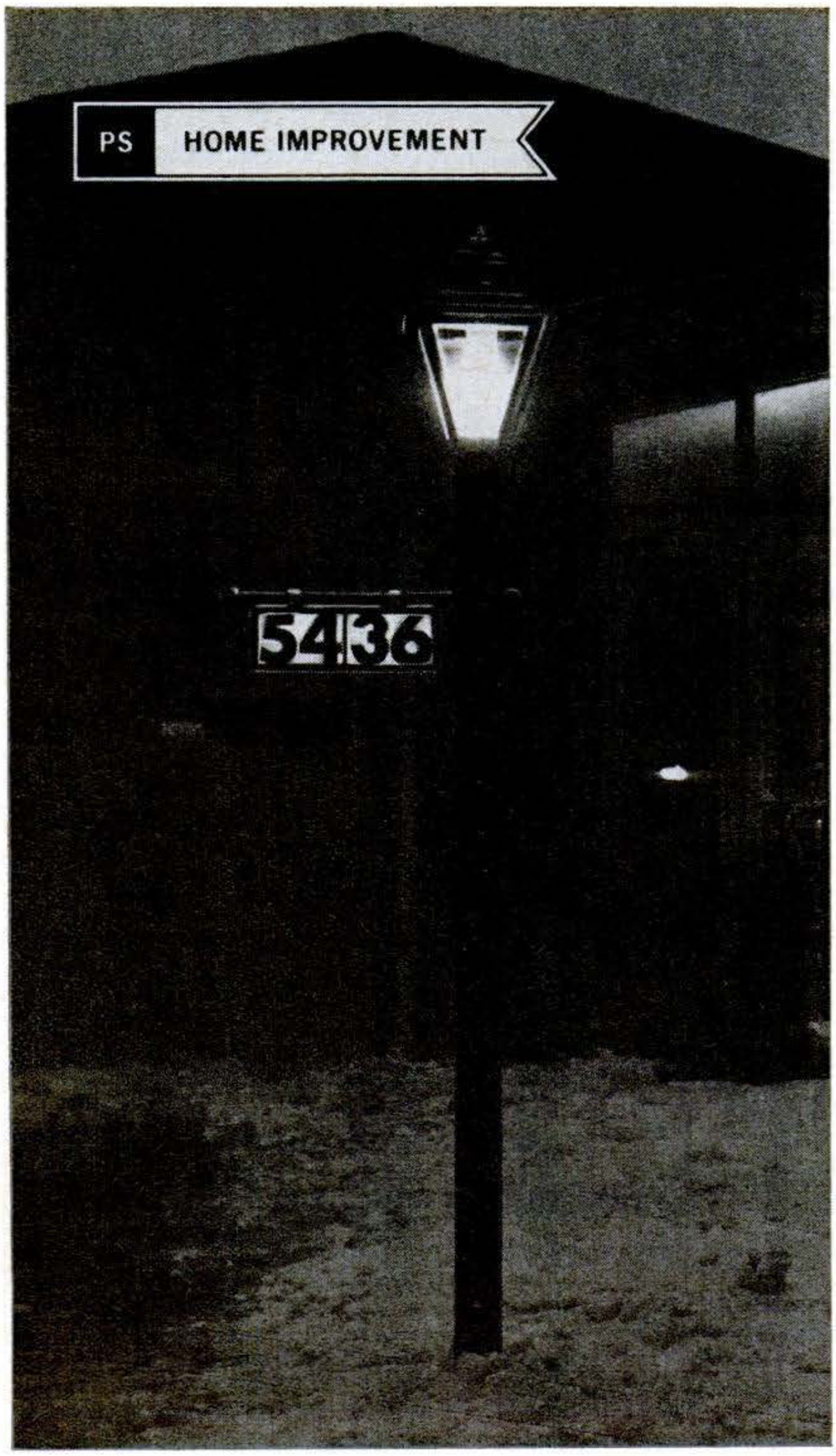


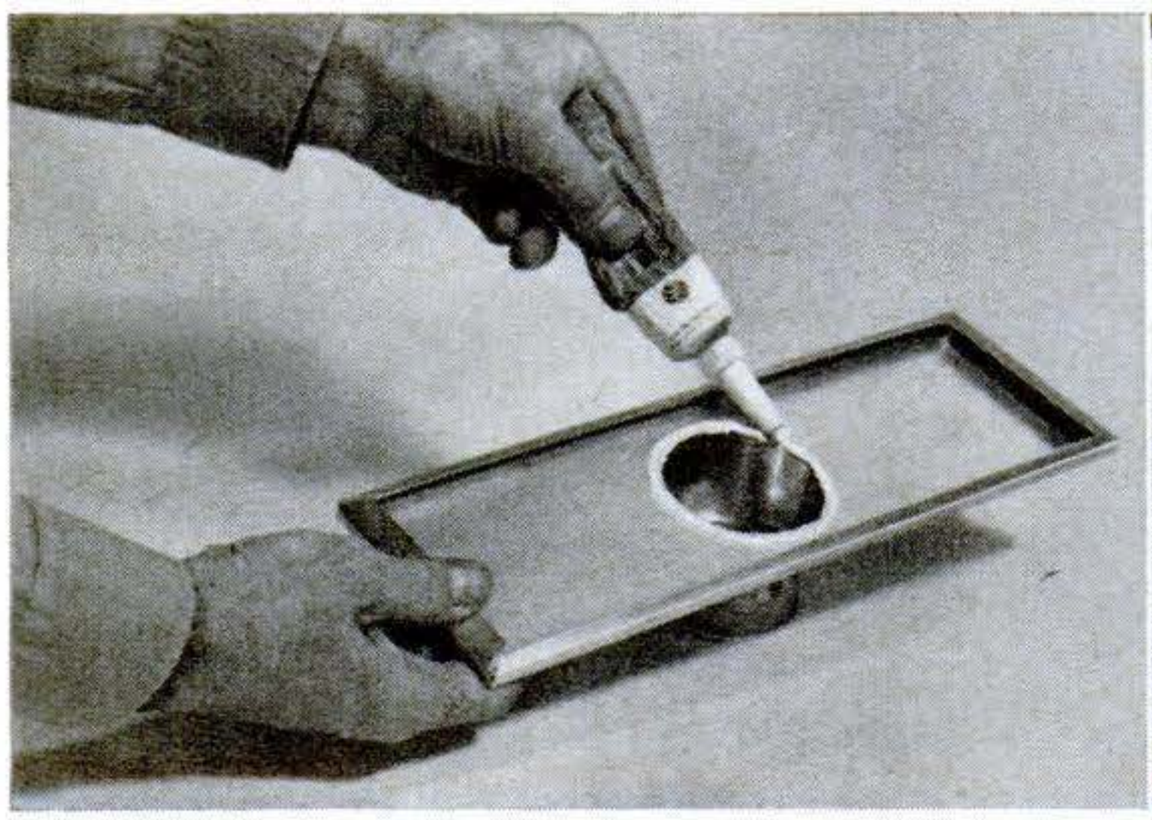
Light Up

By FRANK L. GREENWALD

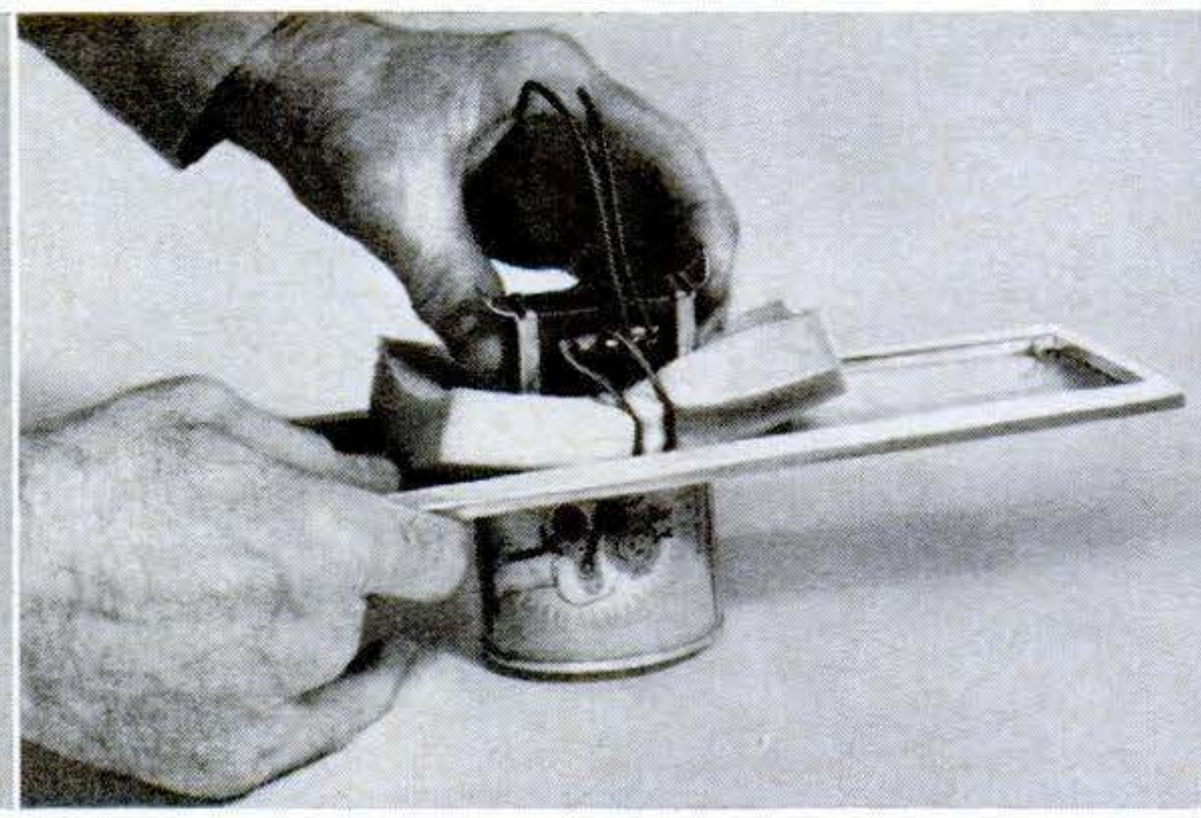
A new lamp design—a flat panel made of steel and ceramic—solves the problem of making your house numbers stand out even on the darkest nights. Called a Panelescent lamp, it's made by Sylvania and it will cost you about 25 cents a year to operate.

This low current consumption lets you build a wiring system that eliminates the need for switches, weatherproof junction boxes, and conduit or BX wiring. One filament transformer mounted on the cover of the nearest junction box steps down the electricity to 12 volts. A second, identical transformer at the sign steps it back up. Ordinary plastic bell wire can be used to connect the transformers. To run the wire to a remote signpost, you can bury it in the ground by simply opening a slit with a straight spade.

The system is especially good for mounting the sign on posts far from 110-volt power. On a



Cut and bend the sheet aluminum as shown in the drawing. The juice-can transformer housing is sealed, inside and out, with silicone rubber.



Stuff transformer in can with ½" foam rubber to insulate it and keep it from rattling around in the can. Seal grommets and leads with silicone.

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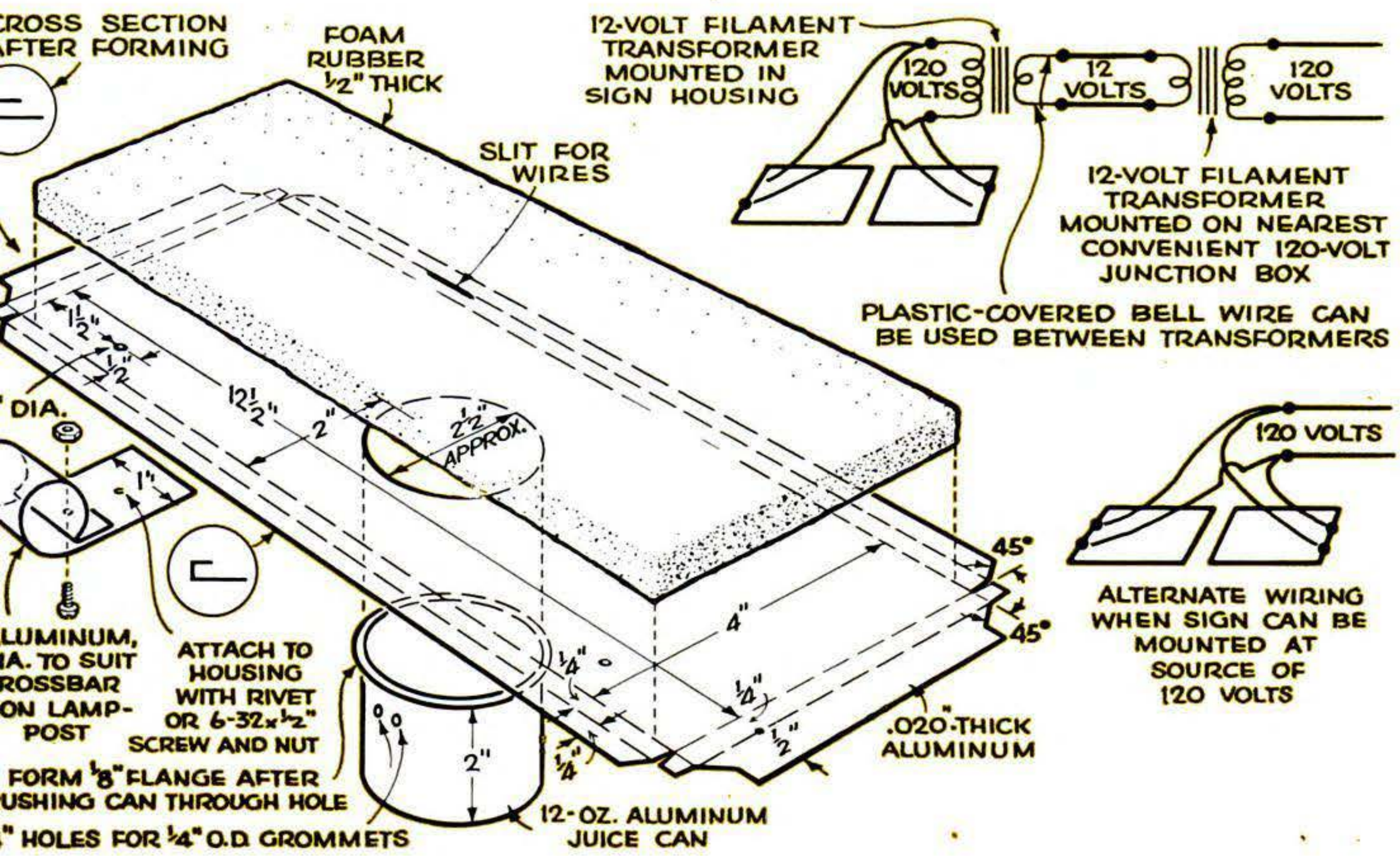
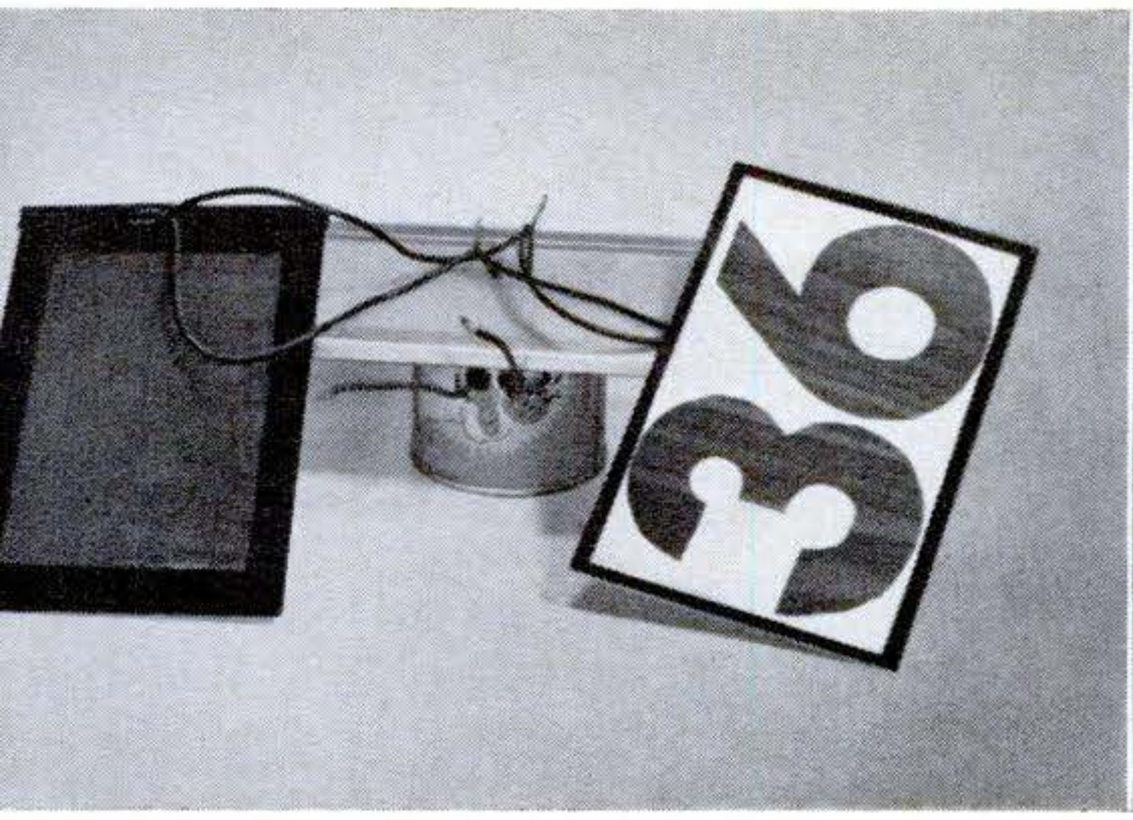
Your House Number

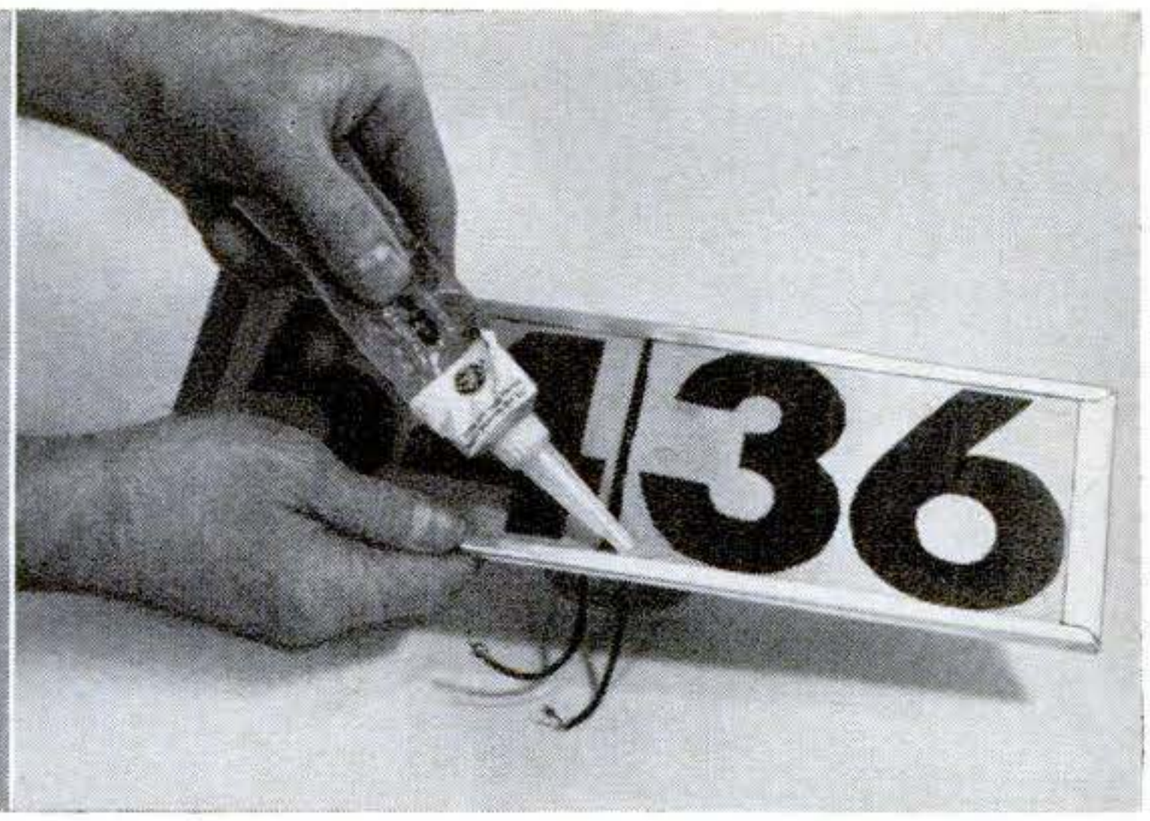
lamppost with 110-volt leads already attached, you would use the conventional wiring system, eliminating transformers and the aluminum juice-can transformer cover.

To make the sign, you need two 4″-by-6″ panel lamps (available from Allied Radio Corp., 110 N. Western, Chicago; catalogue number 8E675). They cost $2.97 each. If you use the transformer wiring system, you'll need the two 12-volt filament transformers, at about $1.50 each. You'll also need some ½″-thick foam rubber, 2¼″-o.d. rubber grommets, some silicone-rubber sealer, and a 12-ounce aluminum can. Dark-colored adhesive plastic sheet (Con-Tact in this case) is used for the cut-out numerals.





Run the primary leads through a slit in the foam. Wire leads to each panel lamp (there are two), and put tape on leads and around edges of lamp.



Slip lamps into the housing and finish bending the edges. Seal corners and edges. Either paint the numbers or cut them from adhesive plastic sheet.

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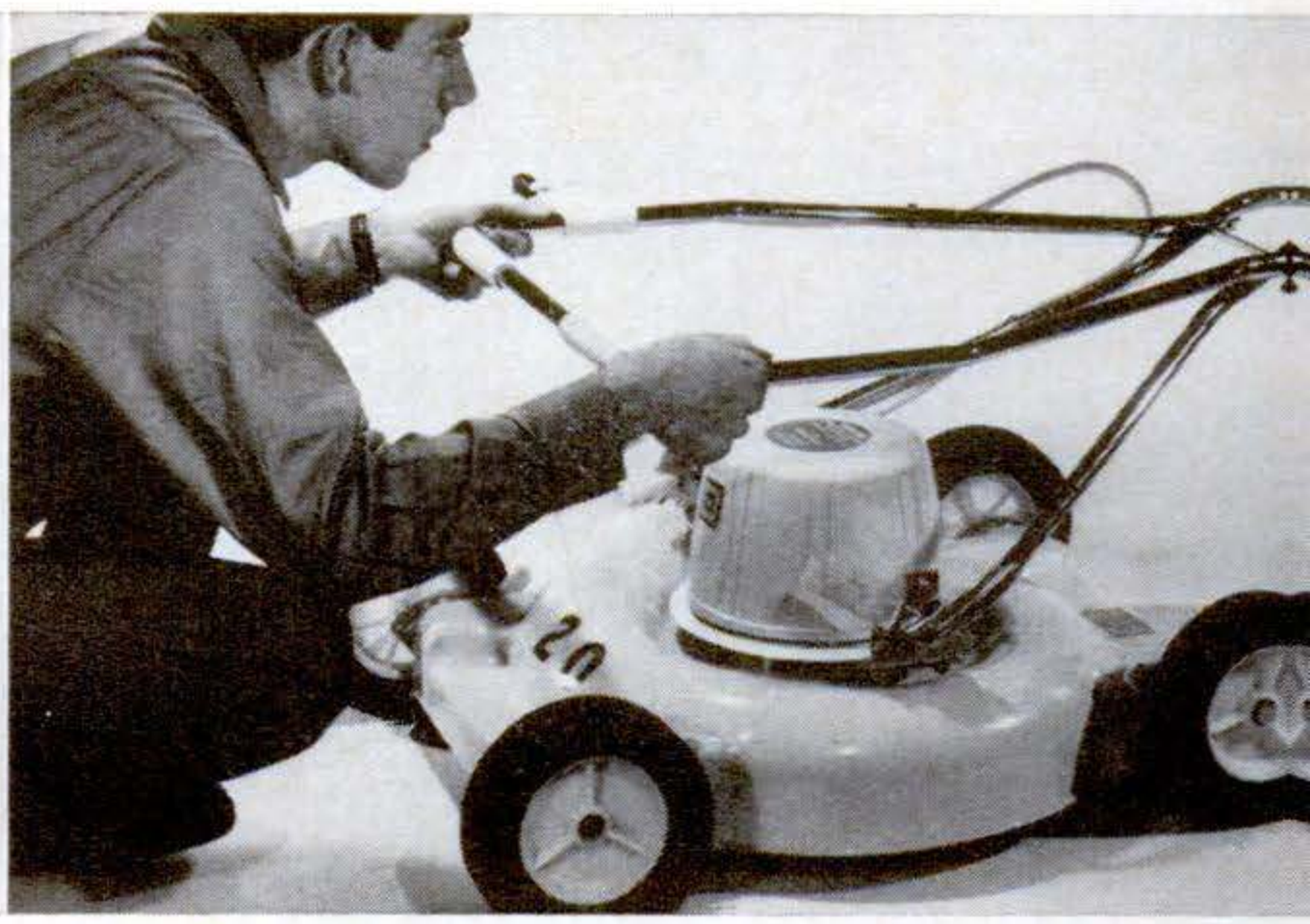
Here Come the

Typical of the field in electric lawn mowers are (clockwise from lower left) Black & Decker's twin-blader, Lawn Boy's 16" job, Sunbeam's cord-carrying model, and Thor's 20" model. All have flop-over handles as an aid to back-and-forth mowing.

New Sears electric comes in three models, all with an 18" cutting swath. The handles on these do not flop over. Instead, you turn the mower at the end of each run. Note cord holder on the handle.



Folding handles like the ones above on a Thor make storing easier. Several makes have them. Others have removable handles. Almost all electrics are light enough to hang on garage wall out of the way.

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Electric Mowers!

New models perform right along with their noisy, gas-burning cousins. You pocket the savings

By JACKSON HAND

When one of the biggest manufacturers of portable power tools breaks into the lawn-mower market with two classy electric models (Black & Decker) . . .

When a large manufacturer of small gas engines and outboard motors makes a feature of its electric mower (Outboard Marine's Lawn Boy) . . .

When one of the big names in electric tools turns over a large share of its first-floor space at the New York Hardware Show to an electric mower (Thor) . . .

When one of the best traffic stoppers at that same show was a specialist in electric lawn mowers (Sunbeam) . . .

And when several leading gas-mower makers admit they have electrics in the works for next year (Toro among others) . . .

That ought to convince you that an electric *may* be what you should buy if you're in the market for a new mower this year.

How good are electrics? They mow as well as any other rotary, but their capacity is limited. They don't go wider than about 22″. If you have a patch of grass that calls for more wingspread, go gas. If you want to ride, go gas.

But on average lawns an electric mower is fast, efficient, convenient, economical, safe, and just about noiseless—which you and your neighbors will all appreciate.

Electrics have the power. If you're one of those who tend to think electric lawn mowers are kind of puny, think again. Typically, a good electric has a universal motor rated at about one to 1.5 hp. Universal motors run at about 15,000 r.p.m. or so, as is done in the Lawn Boy, the Thor, and the single-blade Sunbeams, and you get three things:

- Power. The high load torque of such mowers equals that of at least three-hp. gasoline-burning engines.
- Minimized slow-down under load.
- Quick stop of the blade when you turn the switch off—an important safety feature.

Twin-blade mowers such as Black & Decker and two Sunbeam models have belts instead of gears to reduce motor speed and provide equivalent power. Black & Decker mowers have flat belts, fiberglass reinforced, that operate without overheating at high speeds. Sunbeam uses toothed timer belts, necessary because the side-by-

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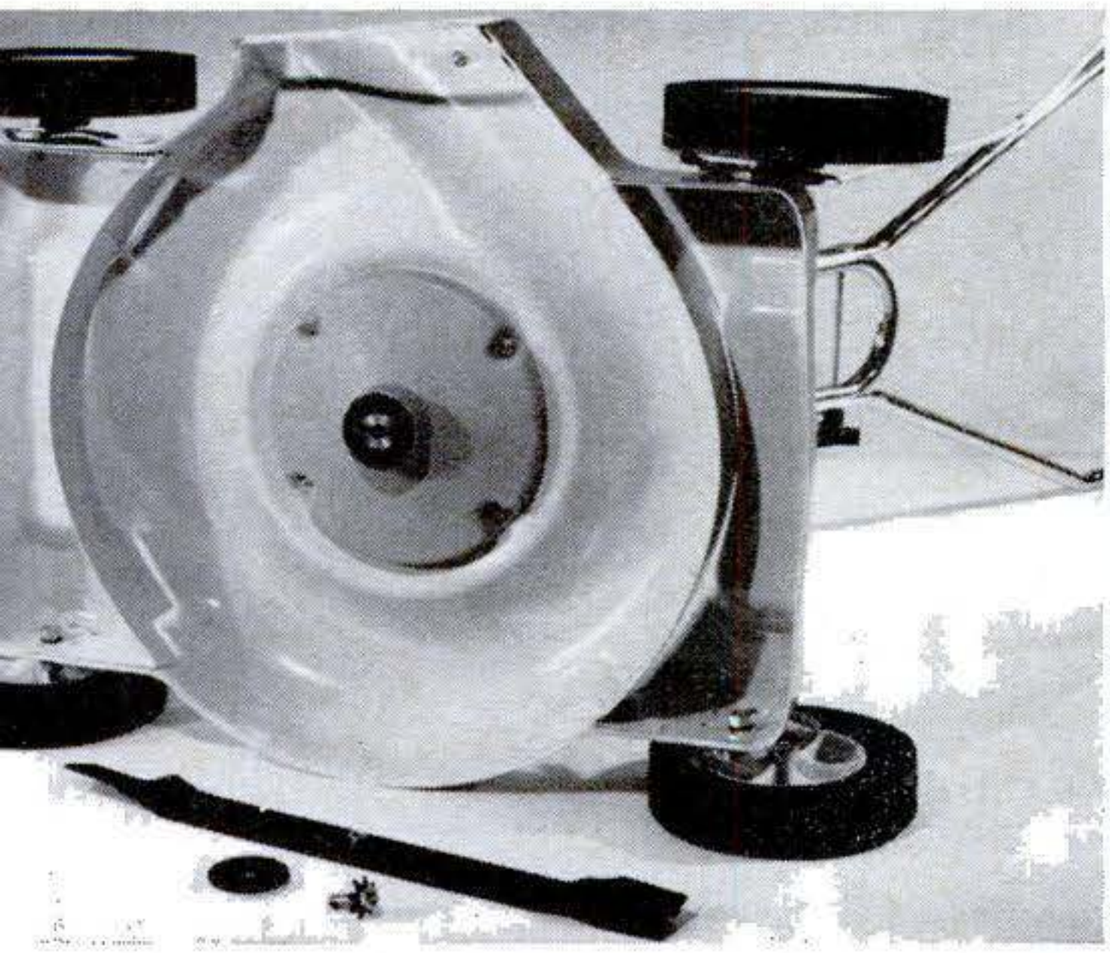

Blade is insulated from the shaft by fiber bushings on the Thor double-insulated mower. The two new Black & Decker twin-blade electric models also offer double insulation. Others use three-wire cords.

Biggest Sunbeam model has a cord reel mounted on the motor spindle, picking up enough torque to take up slack as you mow toward the outlet. A slip connection lets the cord pay out as you mow away.

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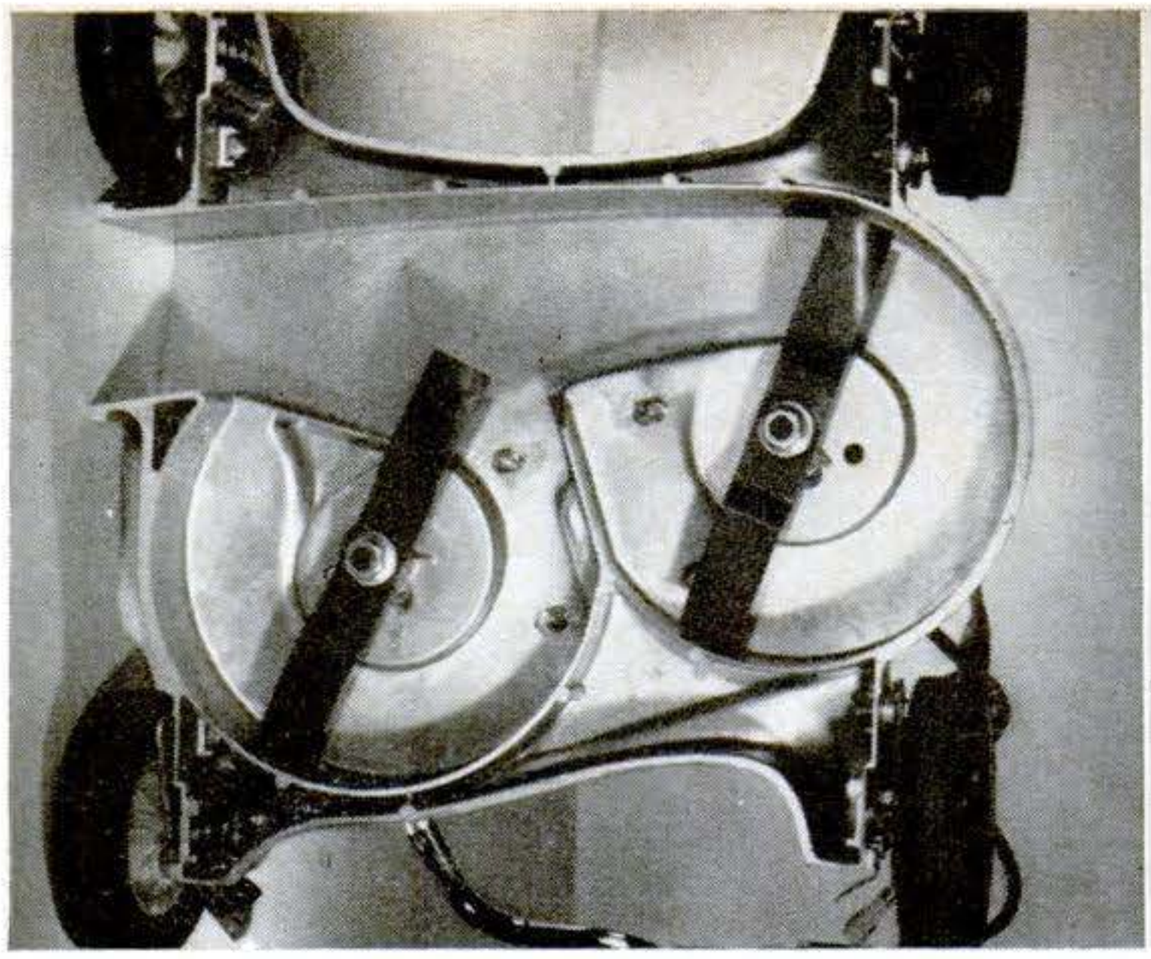

Black & Decker's twin-blade model has blades staggered so they don't interfere with each other. A major advantage of two-blade design is a shorter wheelbase. This makes handling easier. Belt gear-down reduces blade speed to safe limits.

Sunbeam has twin grass bags for its twin-blade, twin-chute electric model. Each of the discharge chutes is aimed at the inside of adjoining wheel. Wheel thus serves as a foil for any object thrown from chute in case you don't use the grass bags.

side blades must be synchronized so they don't hit each other. (The Black & Decker blades are staggered.)

Since blade-tip speed is an important factor in safety, held to 21,000 feet per minute by the industry's safety code, these gear-downs serve the double function of bringing lightweight electric motors into efficient power range and of reducing blade speed to a point where hard objects thrown by the blade are less likely to be lethal.

How safe are electrics? Instruction books tell you not to mow the lawn with electrics when it is wet. Common sense suggests that you wear rubber-soled shoes.

Black & Decker and Thor mowers have double insulation for increased safety. Other makes have three-wire cords, the third wire providing a ground. Since electricity always travels along the best conductor it can find, this ground wire takes off a short instead of letting it travel to the ground via the operator—you.

Mechanically, electrics are exactly as safe or dangerous as gas rotaries of equivalent design. This means they meet American Standards Association safety standards—if they carry the safety seal of the industry. Beyond that, it's up to you to operate them sensibly.

How much trouble is the cord? None, as long as you mow back and forth—not around and around. Most electrics have flop-over handles. At the end of each run, you flop the handle without turning the mower. Some makes have non-flop handles; Sears is one. With these, you turn the mower around at the end of the run—in alternate directions so the cord doesn't become twisted. In all back-and-forth mowing, the cord drags along the mowed area and there's little chance that you'll run over it. Cords are usually 100′ or 150′ long.

The biggest cord problem may be storage. One Sunbeam model has a cord reel mounted on the mower deck, activated by slip connection with the shaft so that it takes up the slack as you mow toward the outlet and pays the cord out as you mow away from it. Black & Decker provides a means of winding the cord up on the handle. In some cases, the cord is a hank of wire. In no case is the cord-storage problem insuperable—but it is there.

One type of electric mower with no cord problem is the rechargeable battery-powered version introduced a year or so ago by Lambert. Its battery will handle a fair-size lawn between chargings. Undoubtedly, as batteries get better and cheaper, the popularity of battery models will boom.

NEXT MONTH:

The Case for Buying a Reel Mower

. . . plus a roundup of news about all kinds of gas-powered mowers

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ELECTRIC LAWN MOWERS AT A GLANCE

Make	Size	Housing	Blade	Handle	Weight	Price*
8 BLACK & DECKER Standard	18″	Cast aluminum	Double	Loop, easy-off	31 lb.	$69
Deluxe	18″	Cast aluminum	Double	T-style, folding (with up-stop)	38 lb.	$89
J LAWN BOY	16″	Cast magnesium	Single	Loop, easy-off (with up-stop)	34 lb.	$90
J LITTLE WONDER	16″	Stamped	Single	T-style, easy-off	36 lb.	$80
2 SEARS, ROEBUCK Good	18″	Stamped	Single	T-style, non-flop-over	34 lb.	$58
Better	18″	Aluminum	Single	T-style, non-flop-over	38 lb.	$68
Best	18″	Magnesium	Single	Loop, length adjustable	42 lb.	$80
2 SUNBEAM Economy	16″	Cast aluminum	Single	Loop, easy-off	37 lb.	$70
	18″	Cast aluminum	Single	Loop, easy-off	42 lb.	$75
	20″	Cast aluminum	Single	Loop, easy-off	47 lb.	$85
Custom	16″	Cast aluminum	Single	Loop, easy-off	45 lb.	$78
	18″	Cast aluminum	Single	Loop, easy-off	49 lb.	$88
Deluxe	16″	Cast aluminum	Single	T-style	52 lb.	$90
	18″	Cast aluminum	Single	T-style	54 lb.	$100
	21″	Cast aluminum	Single	T-style	56 lb.	$110
Cord Reel	18″	Cast aluminum	Single	T-style	59 lb.	$130
	20″	Cast aluminum	Single	T-style	62 lb.	$140
Twin Blade Standard	18″	Cast aluminum	Double, safety-hinged	Loop	27 lb.	$80
Twin Blade Deluxe	18″	Cast aluminum	Double, safety-hinged	T-style, folding	30 lb.	$90
TTHOR	20″	Stamped	Single	Loop, folding	43 lb.	$89
	22″	Stamped	Single	Loop, folding	45 lb.	$99

*The price may or may not include an extension cord. Prices are manufacturer-suggested in some cases, fair-traded in others.

You recharge this battery-powered Lambert model between mowings.

A 16″ electric is made by Little Wonder, Inc., Southampton, Pa.

The flop-over handle. Back-and-forth mowing is the accepted method with cord-fitted electrics. A lock on the handles of Black & Decker and Lawn Boy mowers keeps the operator from raising the handle unintentionally—and perhaps thrusting a foot under the mower. This lock must be released before the handle will flop over. The up-stop is additionally handy in that you can lift on the handle to move the rear wheels laterally if necessary.

A cord attached on the same side as the discharge chute tends to herd you past the machine on the side opposite the chute, so you don't walk in the path of debris that might be thrown out of the chute. The Sears cord is center-mounted.

Double-chute mowers such as the twin-blade Sunbeams throw clippings to the left and right. On this machine, each chute is aimed at an adjoining wheel and the latter serves as a foil for any thrown object. For convenience—and safety—you can use bags.

Continued

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What do they cost? A comparison between gas and electric is fairly easy since Sunbeam has a gas line that parallels the electrics. Sunbeam's top electric is priced at $139.95 for a 20″ model. The best Sunbeam 20″ gas mower is $149.95. The same differential holds in the middle of the line—an electric 18″ at $88.50 and a closely comparable gas model at $99.95. Drop toward the bottom of the line and you find a minimum electric 18″ at $74.95 compared with a gas job at $88.50.

The Sunbeam line is not aimed at the bottom of the market, however. You can buy electrics for less than these prices, size for size. Sears has one for $58. Gas models come much cheaper, as a visit to any discount house will tell you. But not for comparable quality.

Cost goes beyond price, of course. If an electric lawn mower will handle your yard, it does seem more economical to add the cost to your monthly electric bill.

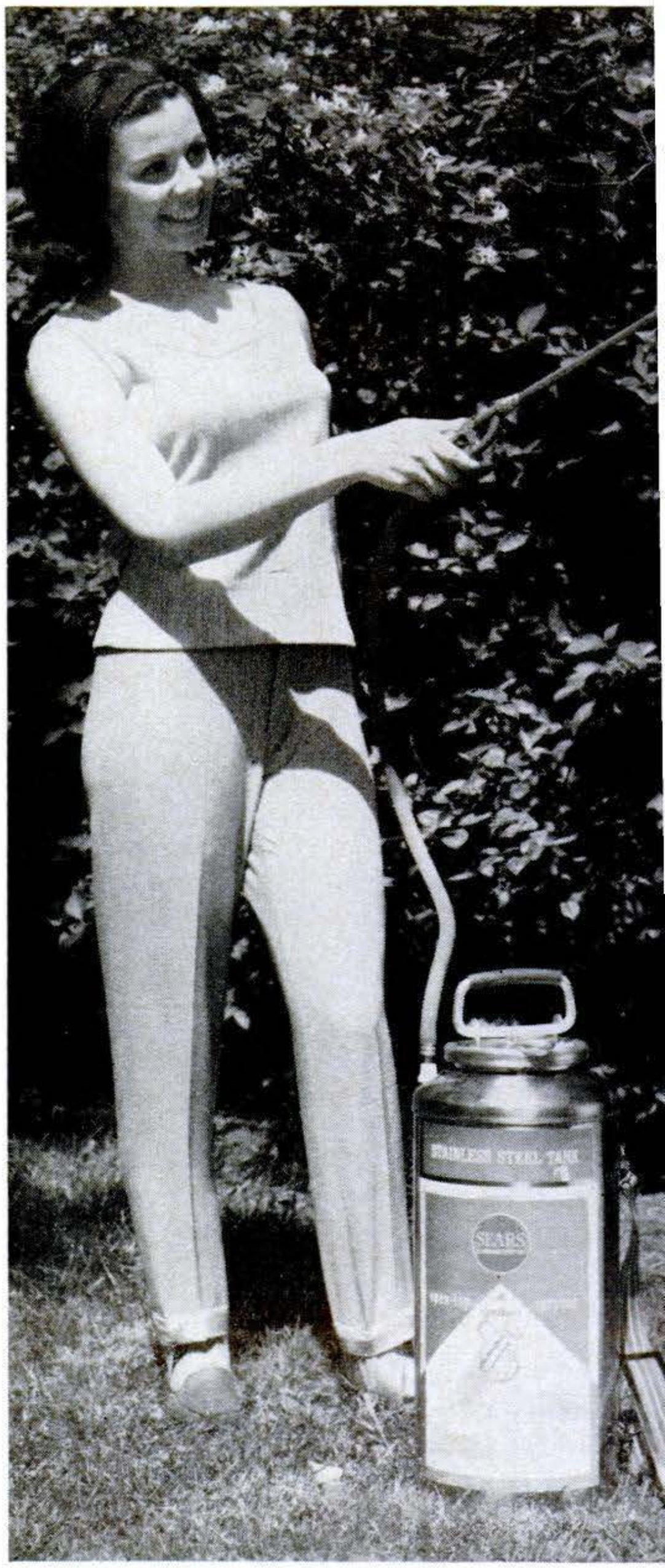
Quality and features. There are no riding electrics. There are no self-propelled electrics. Otherwise, they parallel gas models pretty closely. Some decks have convolute designs said to improve clipping expulsion. Some wheels have quick height adjustment. As with gasoline models, the differences lie mainly in quality of construction and individual styling: Lawn Boy's side rails that make it easy to lift and carry, Sunbeam's dial-twist method of raising and lowering wheels, Black & Decker's folding T handle, Sears adjustable handle length, and so forth.

The twin-blade design has several things going for it:

- Shorter wheelbase, easier handling. The two 9″ blades provide 18″ of spread but only need to accommodate 9″ in fore-and-aft design.
- Protection for the motor shaft, since any impact from striking a heavy object would be absorbed by the blade spindle, not the more costly motor shaft. In addition, Sunbeam has hinged blade ends that swing back under impact.
- Compact, lightweight construction.
- Smoother cut and more finely chopped clippings.

Shopping is limited so far for electric lawn mowers. Scores of companies make gas mowers. But, without question, you'll find more and more electrics on the market each year from now on. PS

What's Nev



New garden-care tools resist rust

Built-in resistance to rust is a feature of two new stainless-steel garden tools offered by Sears, Roebuck. A compressed-air garden sprayer (above) comes in two- and four-gallon sizes. Both have large openings at the top for easy filling and cleaning. The handgrip locks for continuous spraying. A lawn spreader, in 20″ or 24″ widths, has a dial to set the rate of flow. A serrated agitator gives even distribution of either seed or fertilizer.

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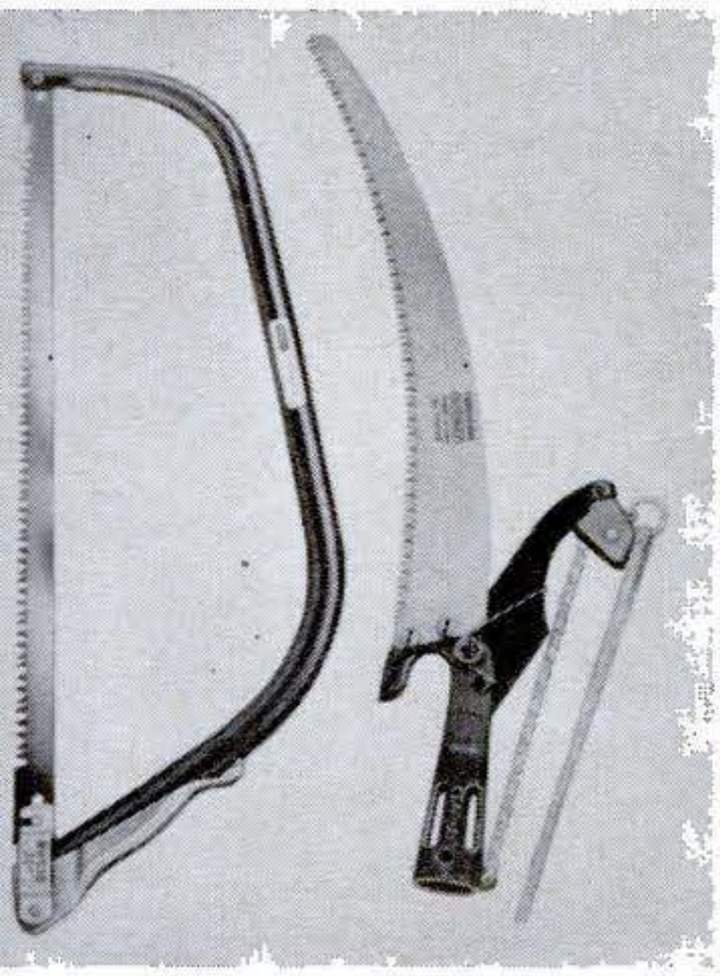
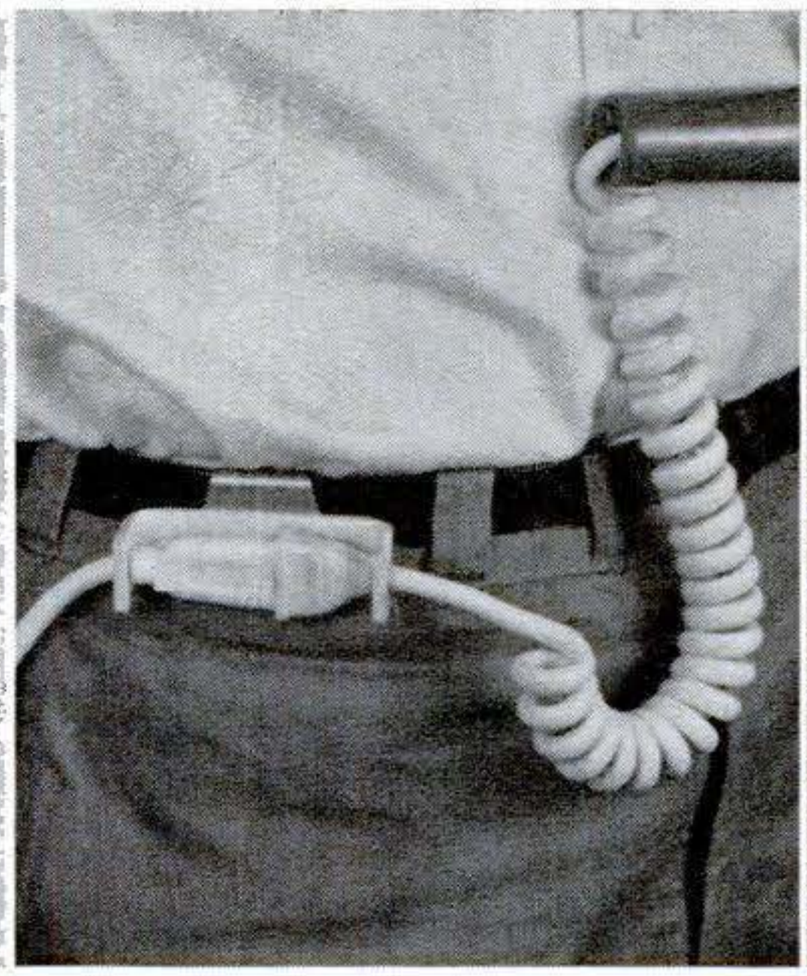
for the Yard and Garden



Two outdoor saws

A 21″ all-purpose bow saw and a combination tree pruner and saw have been announced by Stanley Tools. The bow-saw blades are easily replaced by means of a clamping lever. The pruner has an aluminum head for lightness, a 1″-capacity cutter, and a 15″ saw.



Coiled cord for trimmer

A cord connector that hooks to your belt and a coiled, stretch-type cord are offered with a heavy-duty hedge and shrub trimmer available this year from Millers Falls. The two features lessen the chance of cord cutting. The connector keeps the cords from separating.

"His" and "Hers" shears

Gardening couples are offered matching Disston pruning shears. "Hers" are smaller and lighter than "His." Both have a two-position catch that permits a shortened open-close span setting. Vinyl handles make gripping easy. The H. K. Porter Co., Pittsburgh.

Electric chain saws are light and handy

A new line of light and compact electric chain saws has been announced by the Generac Corp., Waukesha, Wis. They come in three blade lengths: 10″, 13″, and 16″. The 13″ size weighs 16 pounds, the others correspondingly less or more. The saws have high-temperature motor insulation, turbine-fan cooling, and a manual-reset overload protector. The 13″ model ($84.50) draws 13 amps. For remote jobs, the company supplies an engine-driven alternator.

New rotary spreader for fertilizer

A lightweight spreader from O. M. Scott of Marysville, Ohio, weighs only 26 pounds yet holds enough fertilizer—2,800 cubic inches—to treat 10,000 square feet of lawn. Main reason for the low weight: a fiberglass hopper, which is also impervious to corrosion. A rotary broadcasting mechanism under the hopper casts lightweight fertilizer over a swath 8′ wide. A swath control keeps fertilizer or seed off walks. The spreader sells for $49.95.

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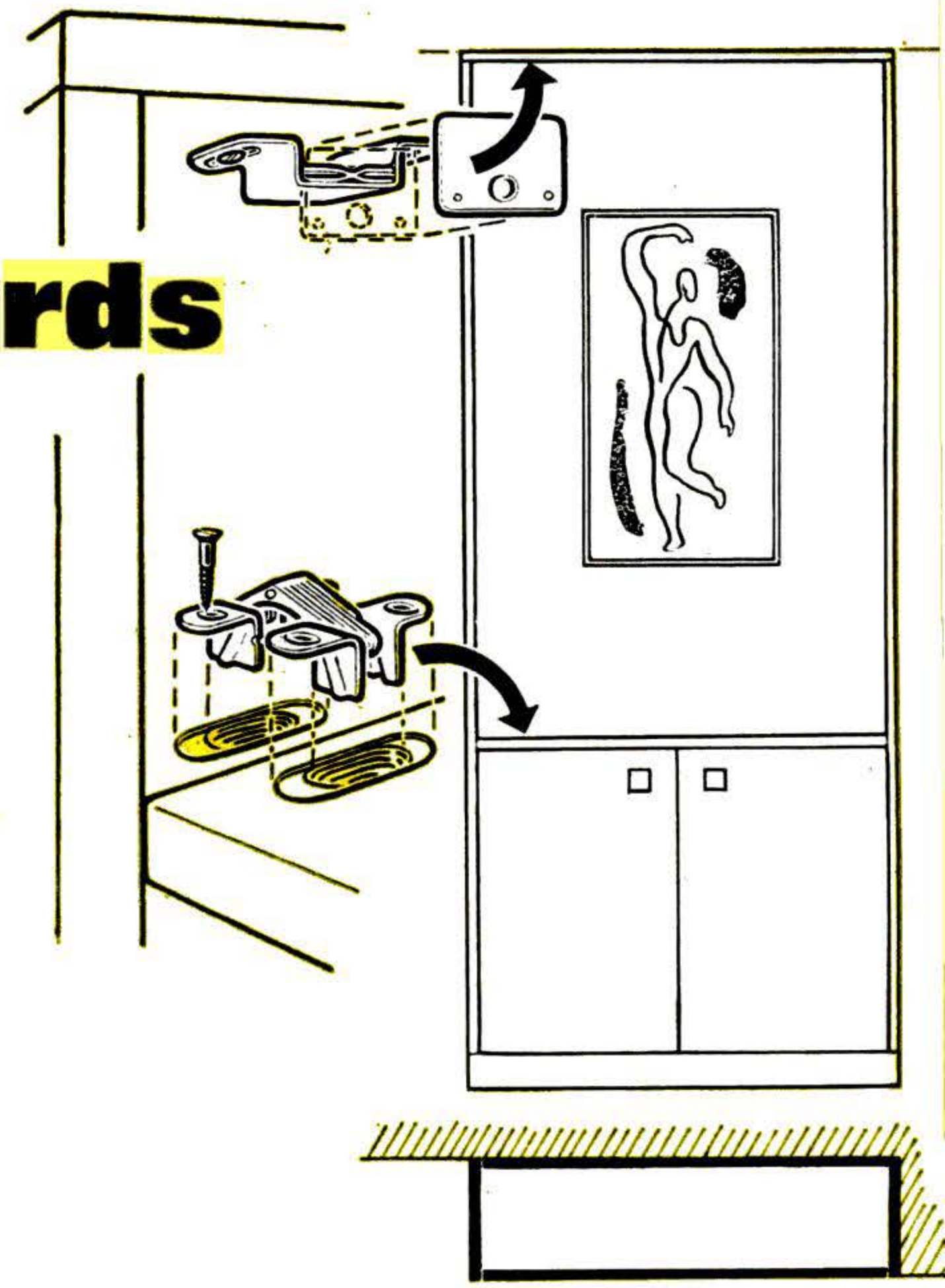
Secret Cupboards I Have Known

Build a house without a lot of concealed nooks? This lady thinks you'd be missing a good bet



By EDITH MOORE JARRETT
DRAWINGS BY SIGMAN-WARD

Ever since I wrote a novel called *The Haunted House* at the age of 10, I've loved the idea of secret cupboards. And I've found that in building a house you can always find lots of odd corners that make wonderful hiding places.

Fate has allowed me to design and build my own small-town homes several times. Each time, driven by my haunted-house fixation, I've amused myself, confused my husband, and befuddled the carpenters by insisting on concealed cubbyholes in funny places.

The first secret cupboard was an accident. Remodeling a bedroom to include a wall-to-wall wardrobe, I found that a small and useless window would have to be covered because it would be inside the closet. In spite of Pete's protests (he was the local carpenter), I got him to board up that window, using tongue-and-groove ceiling inside. This meant that between the two walls there was a tempting space. So I kidded Pete into leaving one of the interior vertical boards loose so that the right sort of pressure from a knowing palm could slide it up and lift it out to reveal that lovely hole.

I don't think we ever did put anything into that secret cupboard except a pound of sugar during World War II rationing. But I always felt it would be a nice hiding place for jewels—if I had any. The tenant who later rented the house tried, but never could locate the hidden compartment I had been mean enough to mention. She papered it over before she left—and that ended its career.

Old-fashioned tongue-and-groove ceiling or modern one-by-six V-groove boards are the clue to most of my secret cubbyholes; the groove doesn't give away any suggestion of a break in a wall.

A duplex apartment I designed has a set

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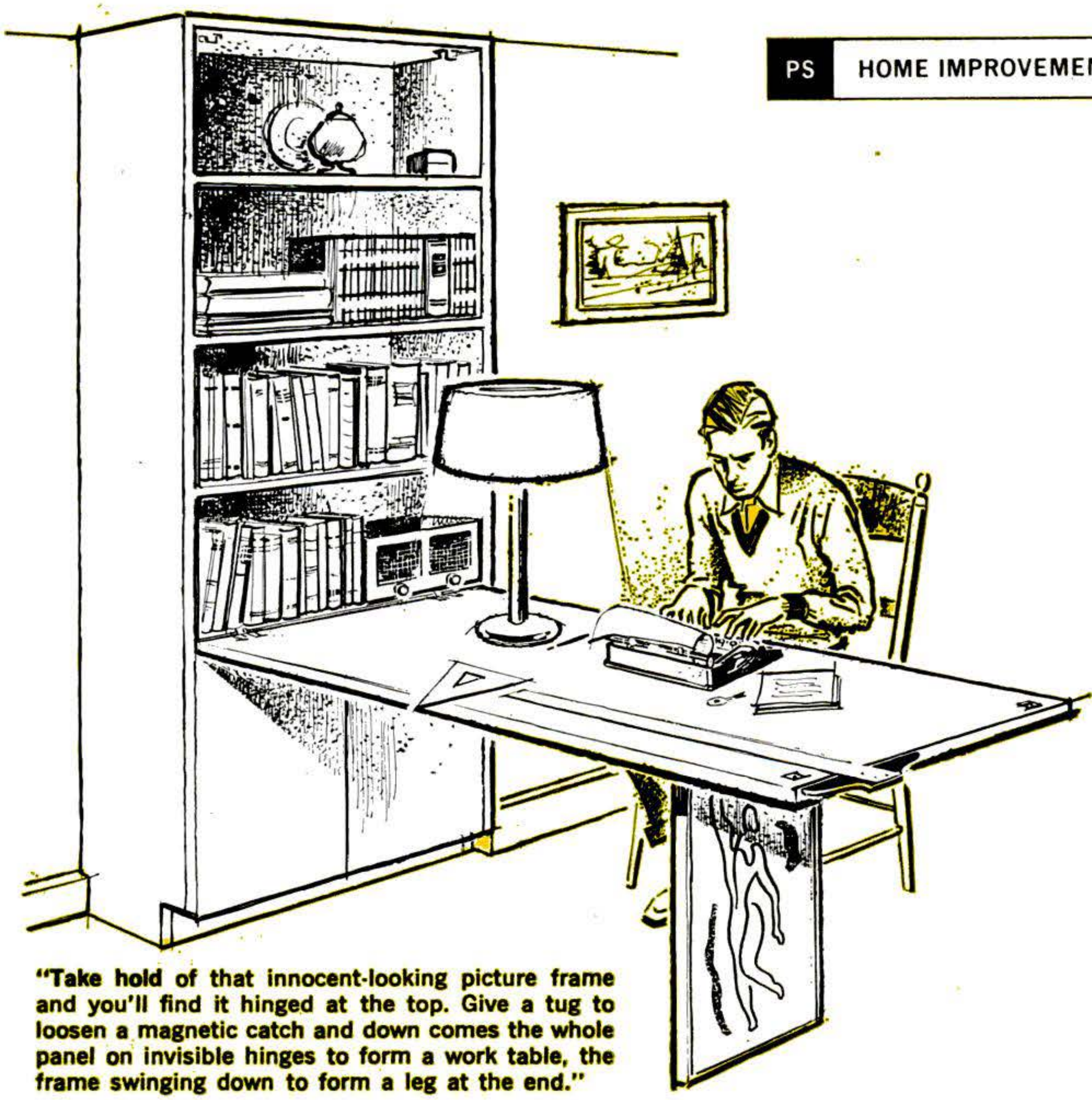

"Take hold of that innocent-looking picture frame and you'll find it hinged at the top. Give a tug to loosen a magnetic catch and down comes the whole panel on invisible hinges to form a work table, the frame swinging down to form a leg at the end."

of two-by-six V-groove redwood-plank shelves (two planks wide) along one end of the living room, each shelf divided into three lengthwise sections by the uprights that support them. The planks of the bottom shelf rest on a base of two-by-sixes standing on edge on the concrete floor, and when I noticed that nice empty space I was tempted again.

So I talked the carpenter (this time it was Henry) into cutting the front plank of the bottom shelf into three pieces so the ends butt under the uprights. This lets them slide out—if you start them with a nail file between the grooves. Underneath is a long shallow trough for treasure.

A secret drawer. In another house, the secret hiding place was a drawer. I designed a recessed seven-foot-long dressing-table counter between two wardrobes at the end of a bedroom. A chest of drawers was placed under each end of the counter, with the middle open as a place to sit and consult the mirror. Then I had my carpenter—it was Bob this time—build a single shallow drawer snugly across under this midsection. It has no hardware pull like the others, however, and its face looks just like a construction detail. This invisible drawer can be pulled open from beneath (if you know how). But since no snooper would ever suspect one was there, it's practically a secret compartment. My present tenant could stow her negotiable securities in it if she had any, but she says that since her kids haven't discovered it yet, it's a fine place to hide her treasured half-ounce bottle of My Sin.

In the last house we built, I really let myself go. In a jog in the entrance hall I inveigled Henry (his turn again) into setting a stack of quarter-circle shelves with an 18-inch radius up to a height of six feet,

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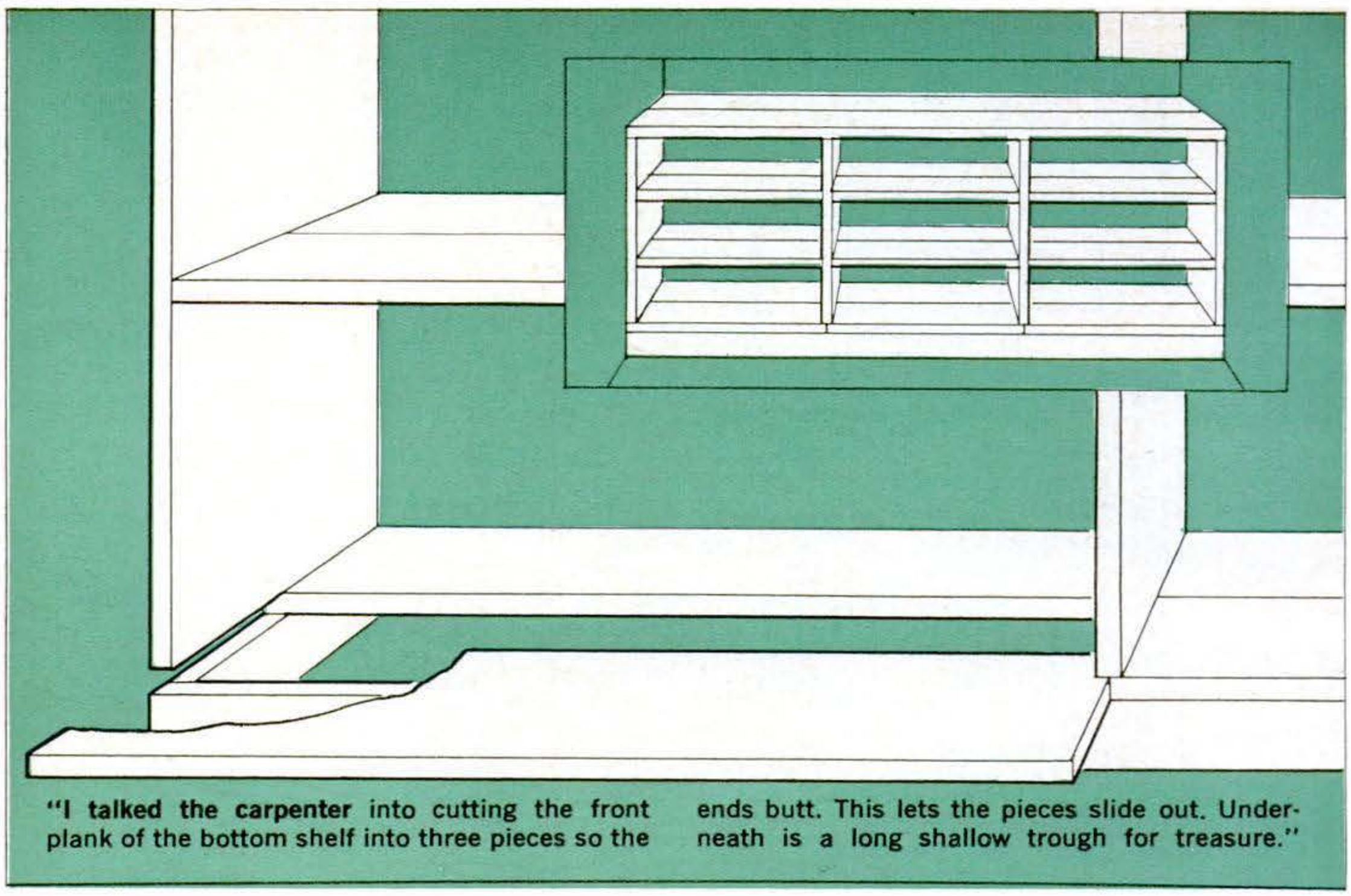

"I talked the carpenter into cutting the front plank of the bottom shelf into three pieces so the ends butt. This lets the pieces slide out. Underneath is a long shallow trough for treasure."

the top shelf serving as support for a galvanized planter basin the same shape. Then Henry boarded up the whole front curve of those quarter-circle shelves with vertical one-by-six V-groove redwood boards high enough to conceal the planter basin, and capped the top edge of the boards with a curving fold of copper, innocently loose and detachable. (The bottom ends of the boards are covered with a narrow wooden molding.)

But one of those vertical boards isn't nailed to the shelf edges. To open this deal, you merely lift off the folded copper strip and push up that board. With a little waxing on the edges, it slides easily against its neighbors.

When I discovered those intriguing magnetic catches and concealed hinges that don't show at all, I really had Henry taking tranquilizers. That invisible stair door, which isn't a secret cupboard but is just as fascinating to me, did it. There's a stairway leading down to the basement from the hall, and since adjoining doors on this side of the hall open into a bedroom and a bathroom respectively, I was afraid some befuddled guest, looking for the latter, would open the stair door instead and find himself bouncing down 10 feet to the laundry.

The hall is paneled with these vertical V-groove redwood boards again, so I had the stair door built of the same boards so that its grooves continue right along with those of the wall, and its outline doesn't show except for that cut across the top. Instead of a doorknob, we put a hidden magnetic catch inside—the kind you just pat to make it pop open, and—try and find that door!

The hinged picture. My biggest and most practical hiding place is actually pretty easy to find. There's a four-foot-wide strip of wall paneling in my study, floor to ceiling, the bottom third of which is obviously the door to a recessed cupboard, with knobs and everything. But on the upper two-thirds hangs a wood-framed picture and you see no knob or hinges to tell you that this panel is also a door. But just take hold of that innocent picture frame and you'll find it hinged at the top. Give the frame a tug to loosen a magnetic catch and down comes the whole ceiling-high panel on invisible hinges to make a work table, the picture frame swinging down to form a table leg at the end. You could hide your fur coat in the deep storage closet that's revealed and all your wampum, or even a poisoned carpenter if you folded him right.

Wampum? Want to know what's in that big secret cupboard? Mostly old books.

We just don't seem to have a thing worth hiding in those secret nooks. PS

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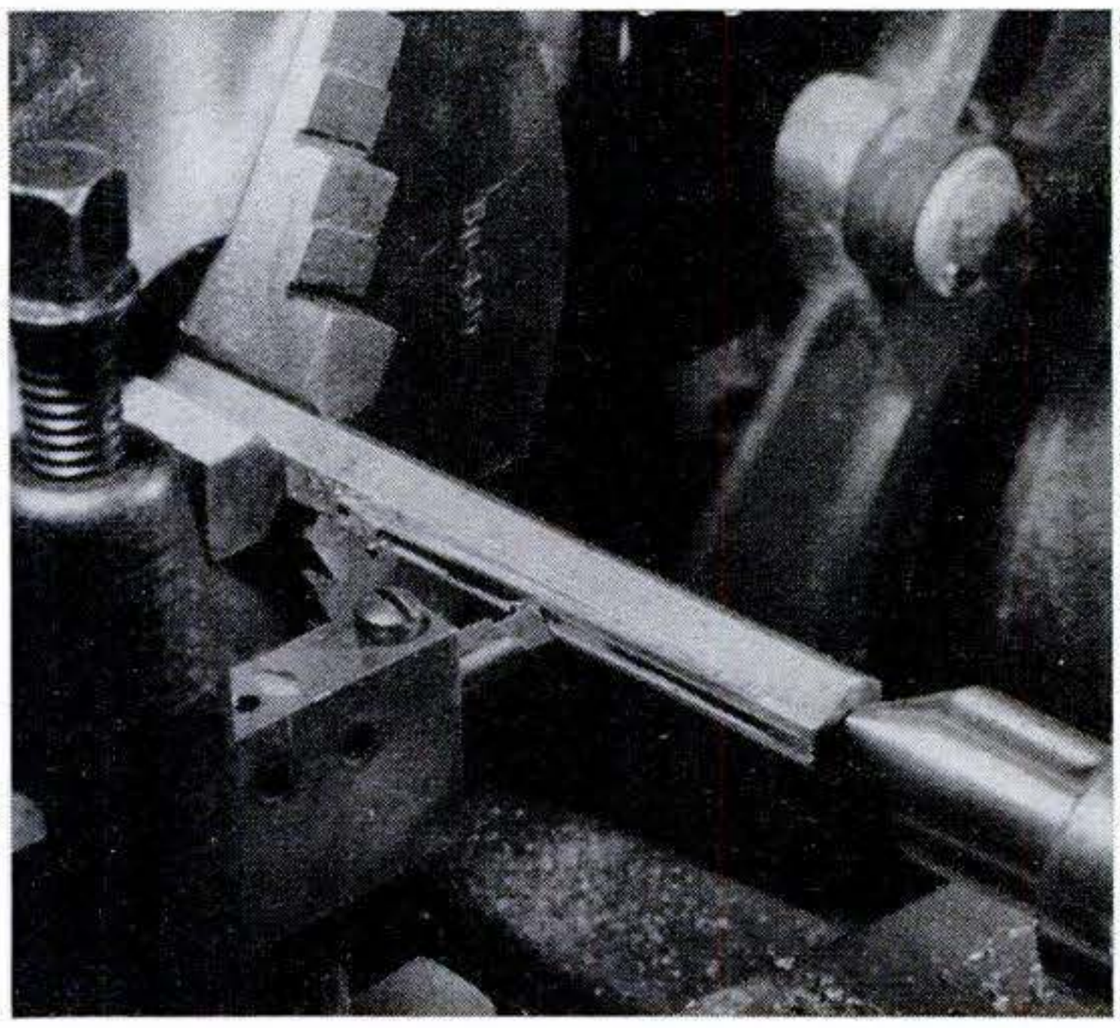
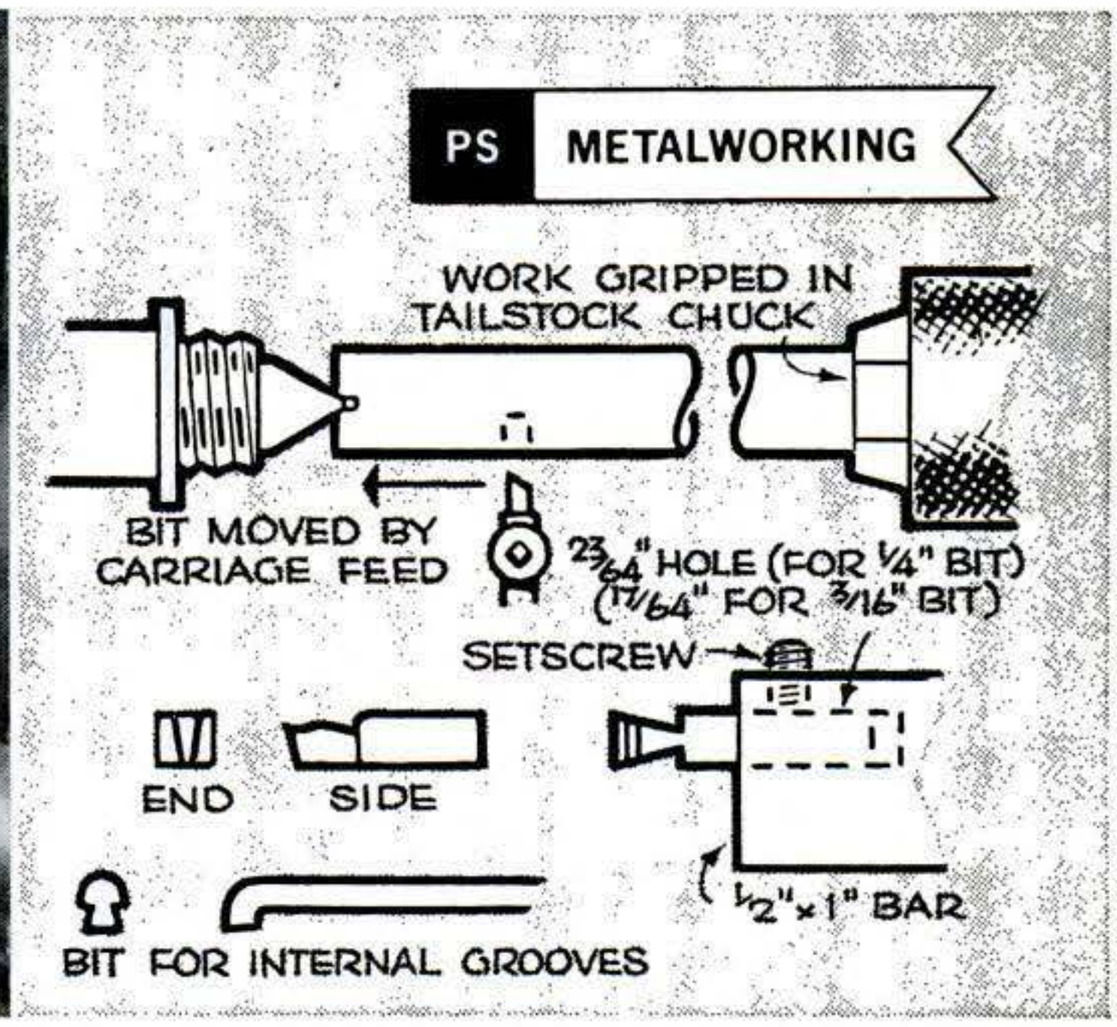
Short Cuts for Machinists

By HARRY WALTON





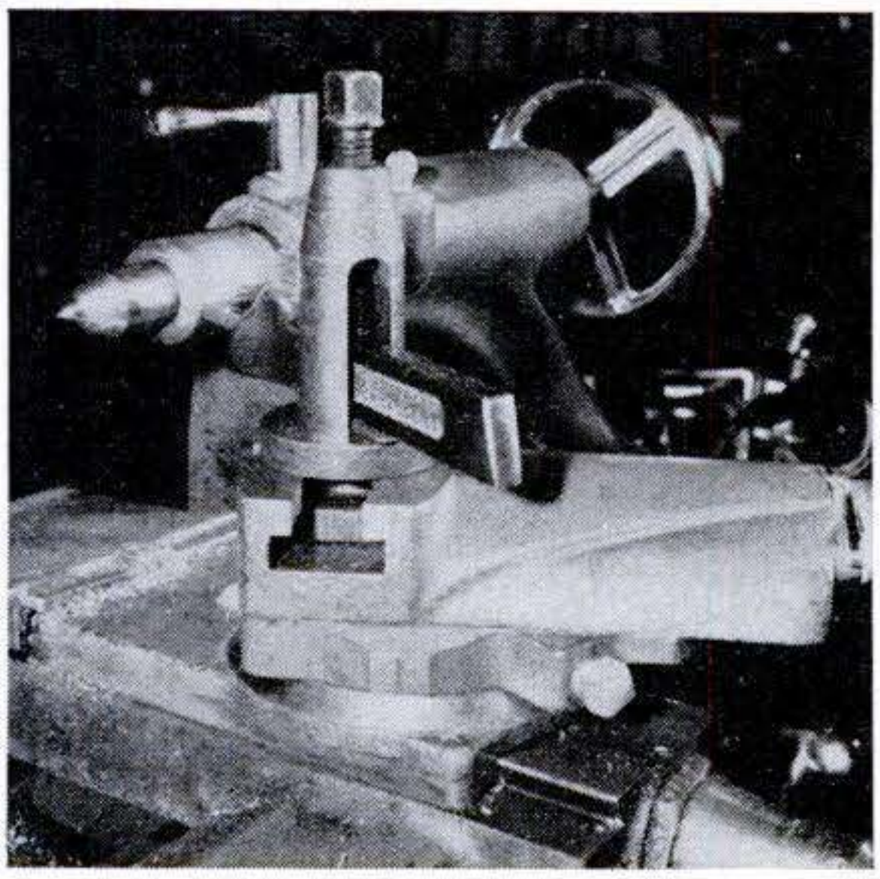
How you can machine keyways, splines, and grooves on a lathe

They're cut using a lathe like a shaper. You do it by keeping the work stationary, and using a square-ended bit set sideways in the toolpost. Either hand or power feed will cut the groove.

The photo shows the setup for machining a groove. A hole is drilled at the inner end of the groove. If the groove will not extend to either end of the work, a hole is drilled at both ends of the groove. The hole should be as wide and as deep as the groove to be machined.

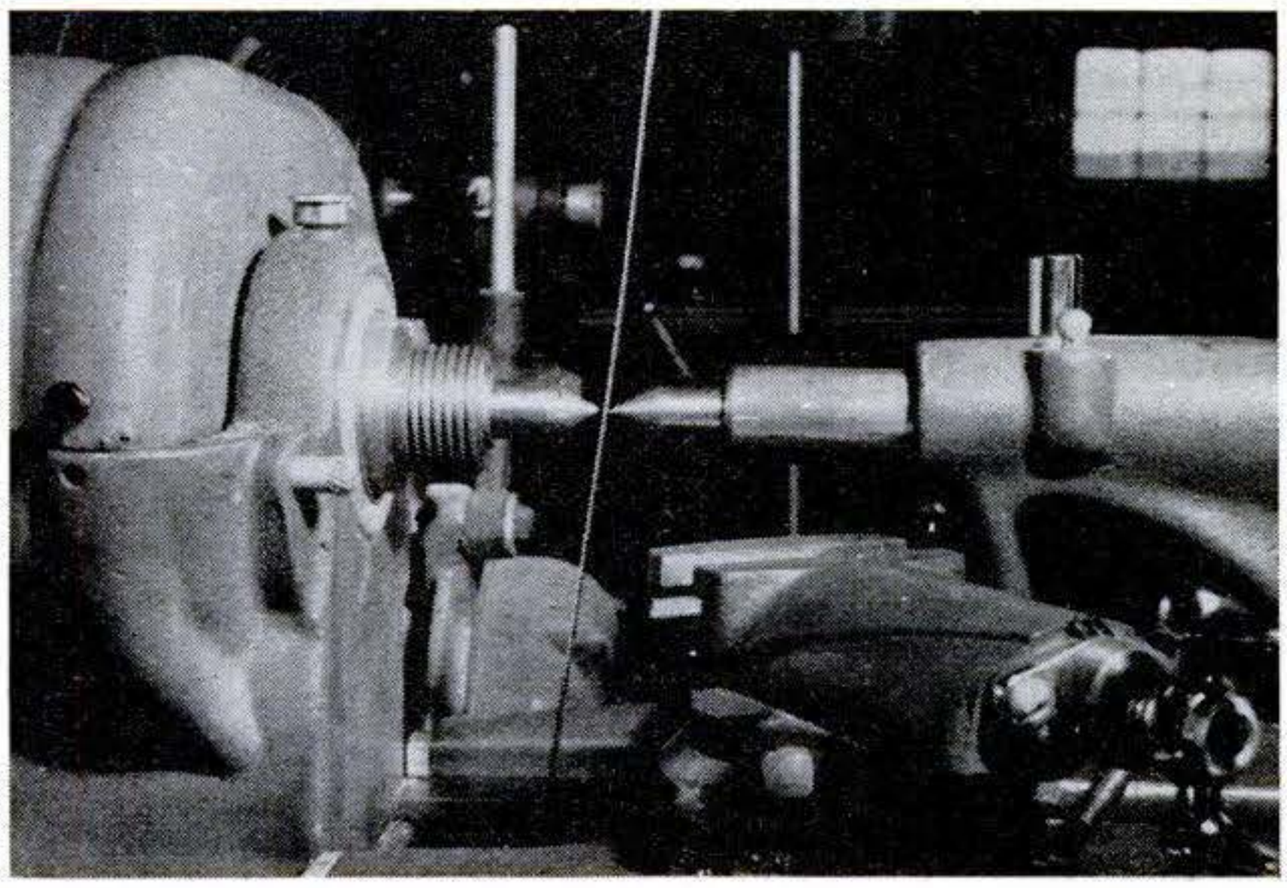
The work is chucked in the headstock, and the spindle locked by engaging back gears. The tool is fed from right to left with the carriage handwheel. Internal keyways are machined the same way, using a boring bit ground as shown.

To power-drive the tool, mount the workpiece on a center in the headstock, and in a tailstock chuck. Set the lathe gears for a moderate carriage speed and cut only a few thousandths on each pass of the lathe bit.



Tailstock mark sets lathe-bit height

A line scribed on the tailstock ram solves the problem of setting the lathe bit on center when you change bits. You make the mark with a sharp-pointed tool set at exact center. You feed the tool for ½" in from the end of the ram, as shown above, scribing a sharp line. Polish off burrs with a fine abrasive cloth. You can run tools up to the ram and set to the line in seconds.



Quick check on lathe-center alignment

You can align lathe centers for most turning jobs by means of a razor blade, hacksaw, or a thin flat piece of steel such as a transformer stamping. With centers in both headstock spindle and tailstock ram, advance the ram until the center points lightly hold the flat piece between them. Place the flat stock vertically to check vertical alignment (photo), or horizontally for across-the-bed alignment. Then advance the tailstock center slightly to apply gentle pressure. Misalignment of the centers will cause the sheet stock to slant away from a 90-degree angle.

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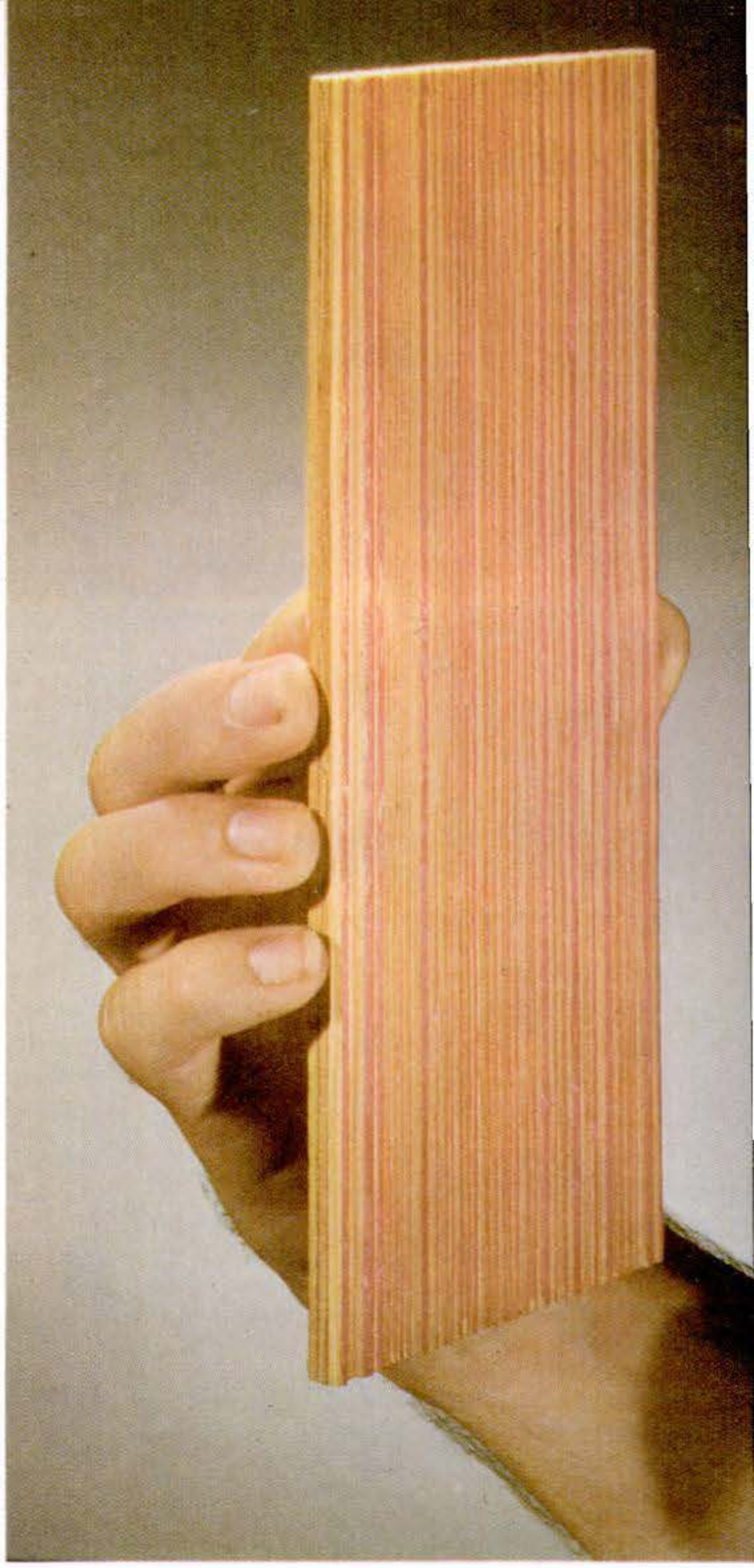
BEST FINISHES FOR WOOD:

Smart Tricks for Finishing Fir Plywood

The handyman's best friend is humble, inexpensive, tremendously useful firply—which also is one of the most difficult woods to finish. Here's how to do it

By JACKSON HAND
PHOTOS BY ROBERT D. BORST



Enamel sprayed from the side over base coat of w

About the least expensive material you can use to make a wooden object is fir plywood, and that's one reason why more of it is sold for home projects than any other material. It's also great stuff to work with. But there's a slight hitch: You need to know a few tricks to make it take a good finish.

The problems arise from the way fir is rotary-sliced – around and around the tree. This produces the characteristic pattern of light soft wood and dark dense wood. These two kinds of wood accept finishing material in drastically different ways. Also, since the sliced wood comes off the tree in a huge, curled, cross-grain shaving which is flattened in lamination, there are unavoidable stresses that reveal themselves as checking. Take a look at any piece of plywood that has been lying around for a while, and notice the fine, parallel, grainwise cracks. Control of these is the second problem in finishing firply well.

The grades. The first step toward a good finish is selecting the right plywood for the job. At the mill it is graded A, B, C, D. A is flawless. B may have some boat patches. C may have some knots. D may have some knot*holes*. Designations such as A-C or B-D mean that one side is faced with one grade and the other – the back – with an inferior grade.

There is no sense in buying a better piece than you need for the job. A functional project is just as solid built of B or C or D as it is of A. However, the better the grade, the

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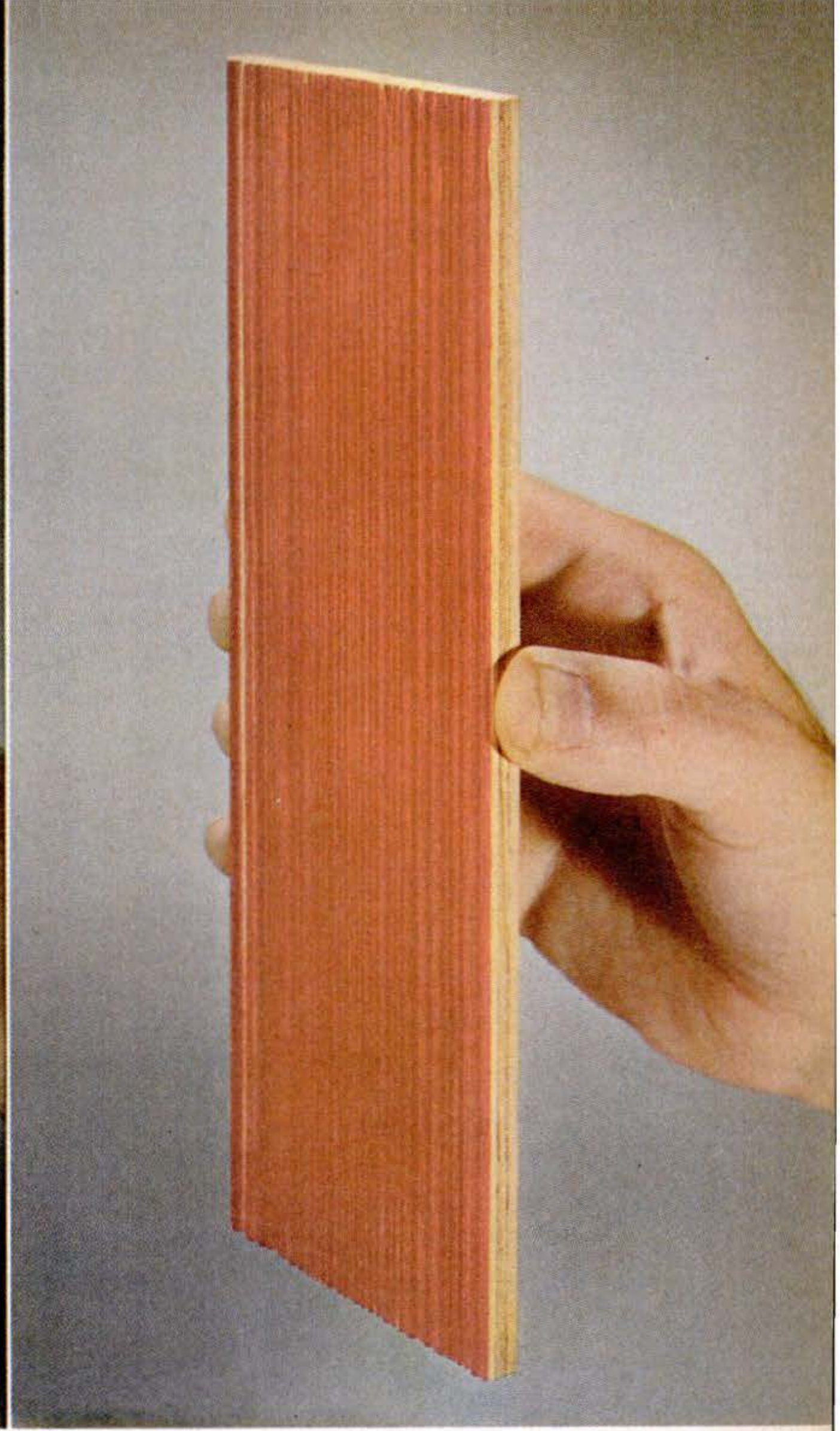

triated plywood gives you changing view as you turn it, since enamel is on only one side of ridges.

easier it is to finish. B grade's boat patches and frequently narrower strips of veneer give you problems at finishing time that may make you wish you'd spent the money for A grade. You cannot hide patches under any clear or stained finish, although enamels cover them. If your project is to be stained and looks are important, you need A grade.

Sanding tricks. Plywood, when you buy it, may not be as smooth as you'd like. At the mill they drum-sand it down to the equivalent of about 3/0. If you want to make it smoother, work with these tricks:

1. Never sand firply without a sanding block big enough to bridge across the soft, light-colored areas. They are so soft that they wear hollow if you use a small block – or sand with the paper held in your fingers.

2. If possible – and this means nine times out of 10–apply the first coat of finish before you sand at all, to act as a sealer. The reason: Sealer or the right finish coat hardens the softwood areas and helps keep them from dishing. Once hardened, the fibers can be made smoother, too. Otherwise, there is little point in going finer than 3/0; the dark, dense areas will get smoother, but not the light, soft areas.

How to control checking. Fir plywood won't check if it is properly sealed against moisture. Do not expect to get sufficient priming and sealing from ordinary primers or from the first coat of a self-priming material.

Continued

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The best results come from soaking it with Firzite, Pentaprime, Rez, Du Pont Penetrating Wood Finish, or other similar materials that soak into the wood and fill the cells and interfiber spaces with resins. Apply these materials only to the bare wood, never over sanding sealers.

Since moisture readily enters the edges, you must seal edges that will butt against other surfaces *before* you assemble the joints. If the joints are glued with a material equal to Weldwood plastic-resin glue, you get a good seal from the adhesive if you apply plenty of it to the edge.

On projects destined for a sheltered life, you have less checking to worry about. Nevertheless, one of the above penetrating sealers is good insurance, even for a dresser-top jewel box with a rubbed enamel finish.

How to tame wild grain. The color photographs illustrate the garish results you get when you stain firply in the raw. By soaking up quantities of stain, the softwood areas go dark, while the denser wood stays about the same. The contrast is too great for good looks.

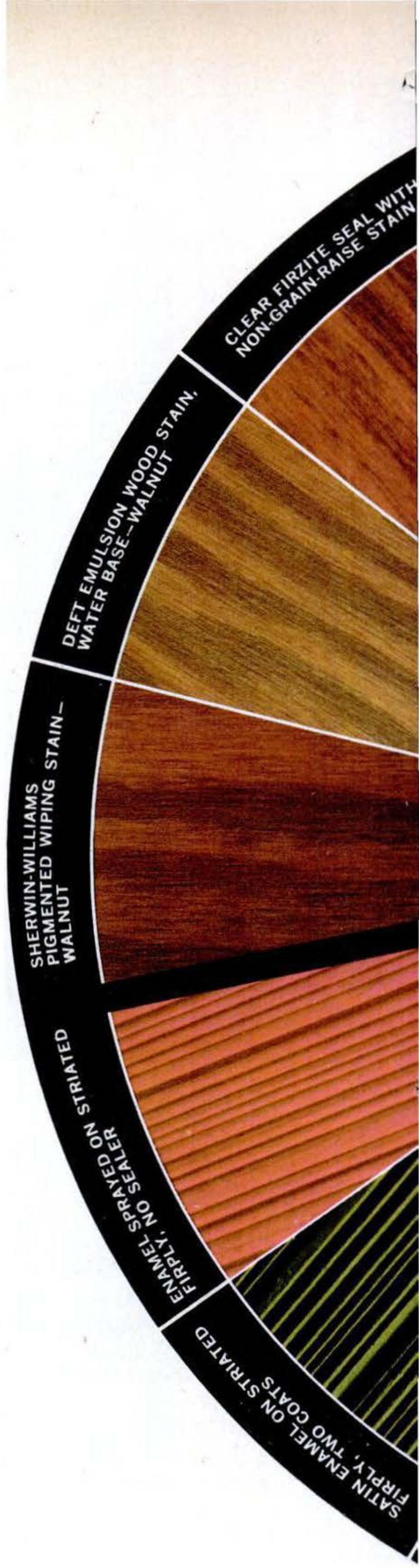
The same standard sealers help you kill wild grain by reducing the capacity of the softwood to absorb stain. Thinned shellac works in the same way, but without the protection against checking. Some workers thin white Firzite with turpentine and use it as a brush-on-wipe-off seal. The soft areas are not only sealed, but they retain enough white pigment to hold the stain lighter in the places where it would normally be darkest.

Paint and enamel. The uneven character of the grain presents less trouble under opaque finishes than under clear – but the trouble is still there. If you want to build a smooth enamel, start with a penetrating seal, to suppress checking and to level off absorption. Be particularly careful not to let sandpaper dip into the softwood areas, because dips are all the more conspicuous with the uniform color of enamel.

Handle the enamel carefully to avoid heavy spots—working up to level with two or more coats, each scuff-sanded thoroughly. Avoid dust, particularly on the final coat. If your project warrants it, a third or fourth coat of enamel, wet-sanded with 400 grit, then waxed, is the equivalent of Chinese lacquer. (Spray-can lacquers can be built the same way, if you take the "quick-dry" fast talk with a grain of salt and give each sprayed coat a minimum of three hours in good drying conditions.)

Paint – in the sense of a utilitarian finish – calls for a slight modification. Outdoors, where much fir plywood is used in residential construction, experienced workers often seal and apply the first coat. Then, in six months or so, when checking is about ended, they put on the remaining coat—or two coats, if the schedule calls for it. This works just as well

[Continued on page 210]



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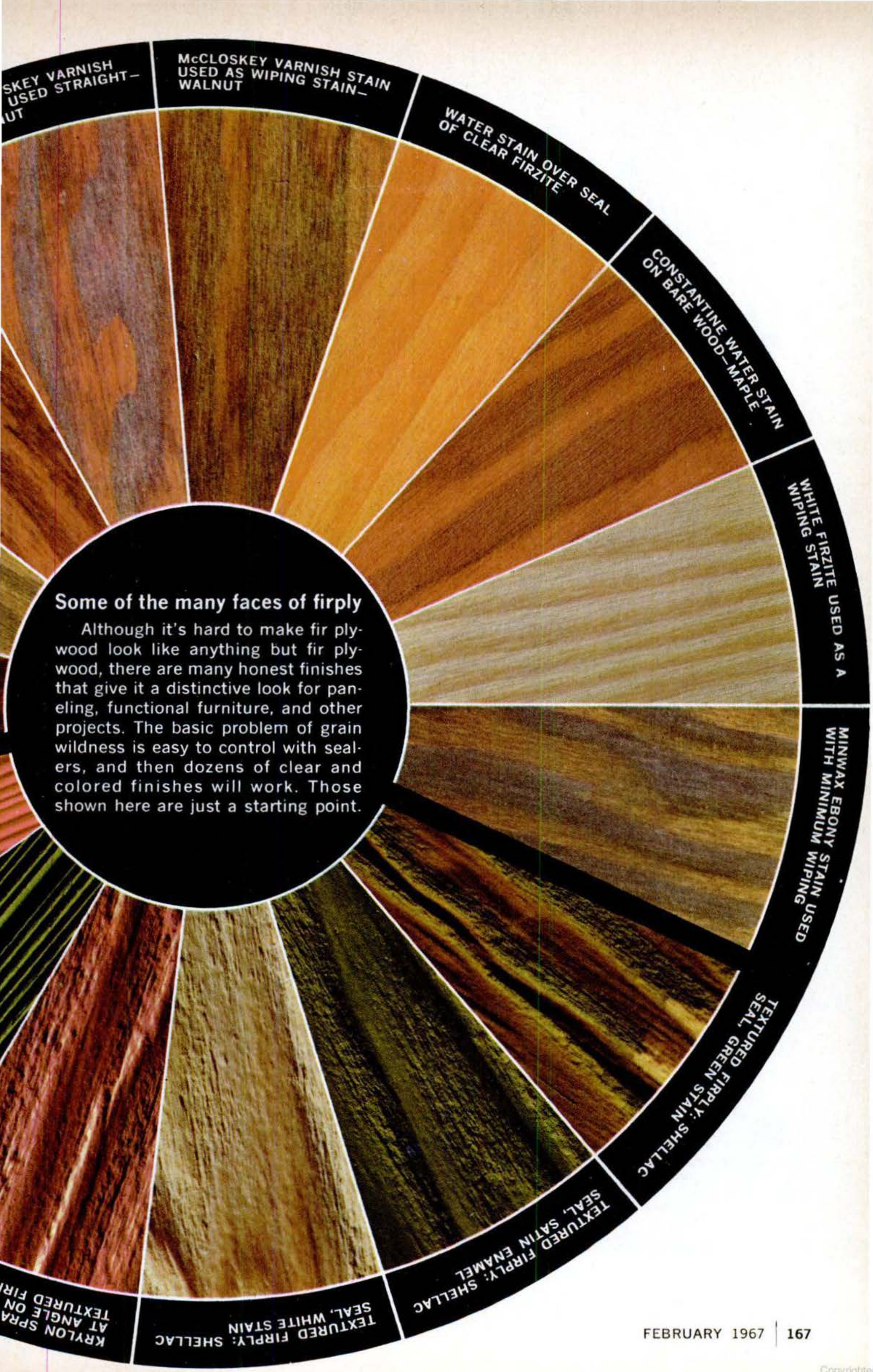

Some of the many faces of firply

Although it's hard to make fir plywood look like anything but fir plywood, there are many honest finishes that give it a distinctive look for paneling, functional furniture, and other projects. The basic problem of grain wildness is easy to control with sealers, and then dozens of clear and colored finishes will work. Those shown here are just a starting point.

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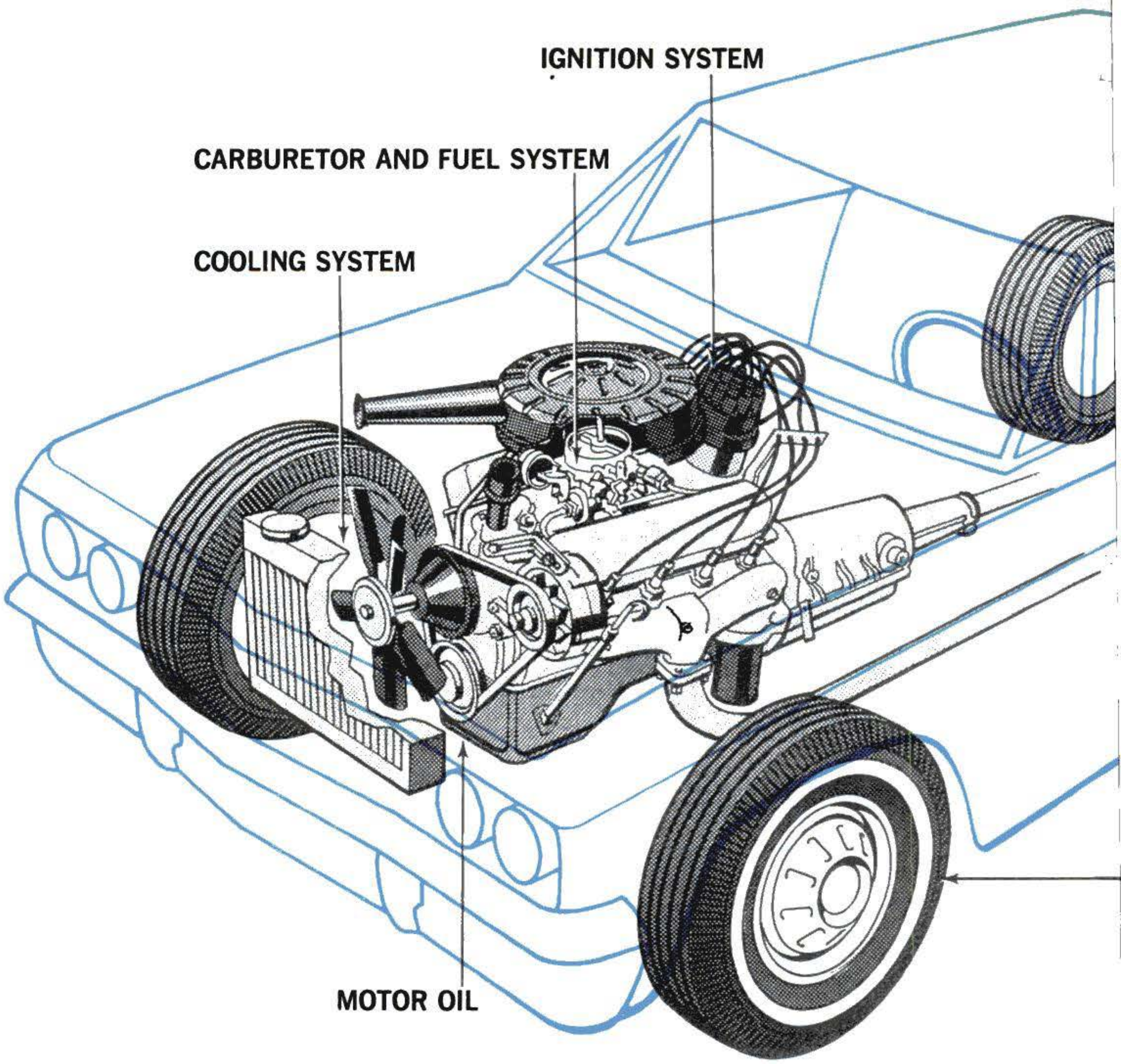

Why Does Your Gas Mileage Drop

Fuel losses come with cold weather—but here are five ways you can cut them

By HENRY T. GURLEY

When temperatures fall, so does your fuel economy. The lower the mercury, the higher the fuel consumption. Until the engine reaches normal operating temperature, the fuel system supplies an extremely rich air/fuel mixture to the engine. This is necessary just to start a cold engine. In warm weather, the rich mixture is needed only for a few minutes—in cold weather, it may be needed for several miles of driving.

Here are five things to check when cold weather sets in:

1. *Condition of the cooling system.* A defective thermostat that opens too early, a summer thermostat, or a defective pressure cap will slow down warm-up.

2. *Condition of the ignition.* Fouled or eroded spark plugs, a broken spark-plug wire, burned or pitted points will cause waste of more fuel in cold weather.

3. *Condition of fuel system.* Check for a sticking choke plate, a sticking manifold heat-control valve, badly regulated fuel pump, or a dirty or too-worn carburetor.

4. *Motor oil.* Use winter oil or multi-

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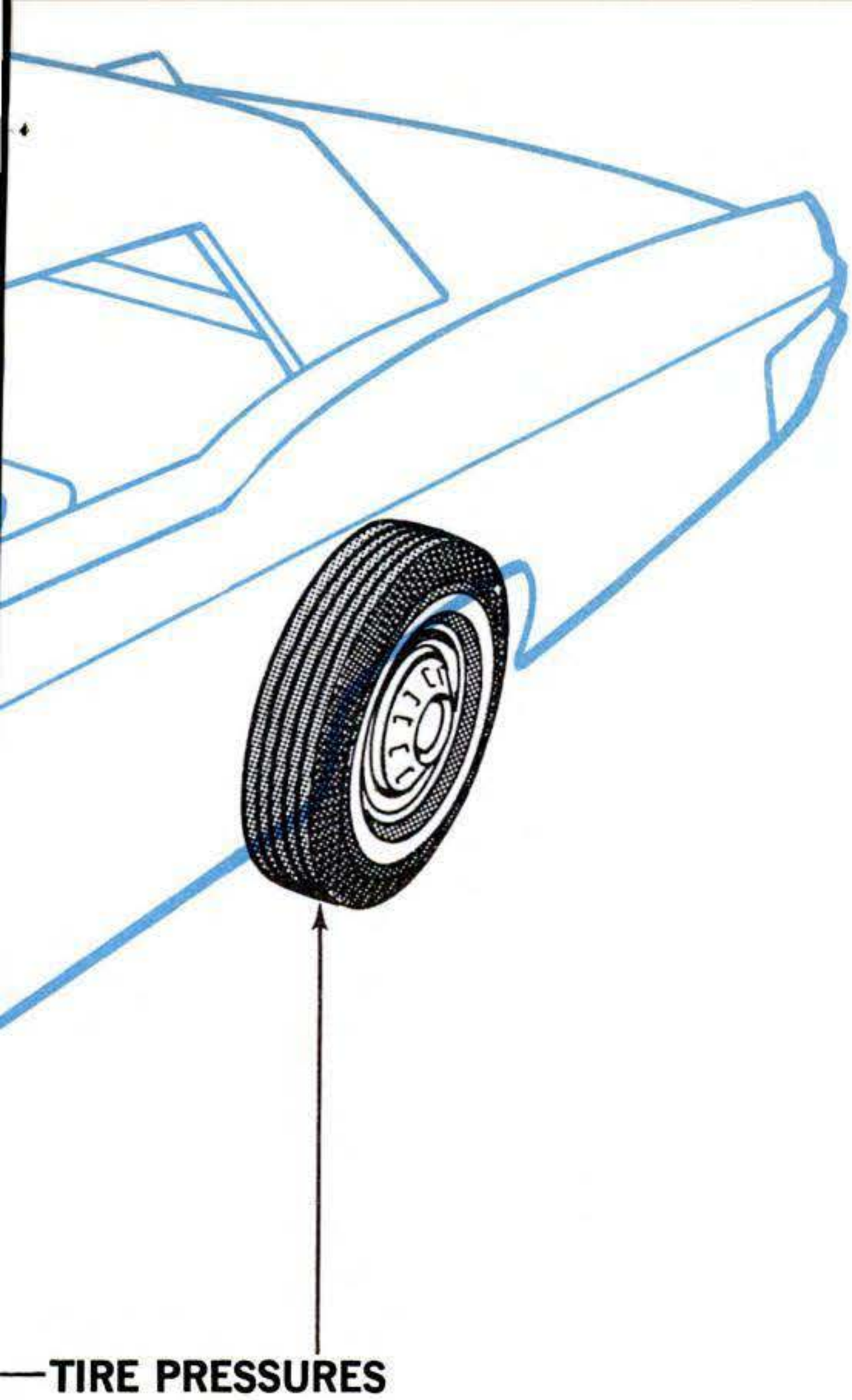
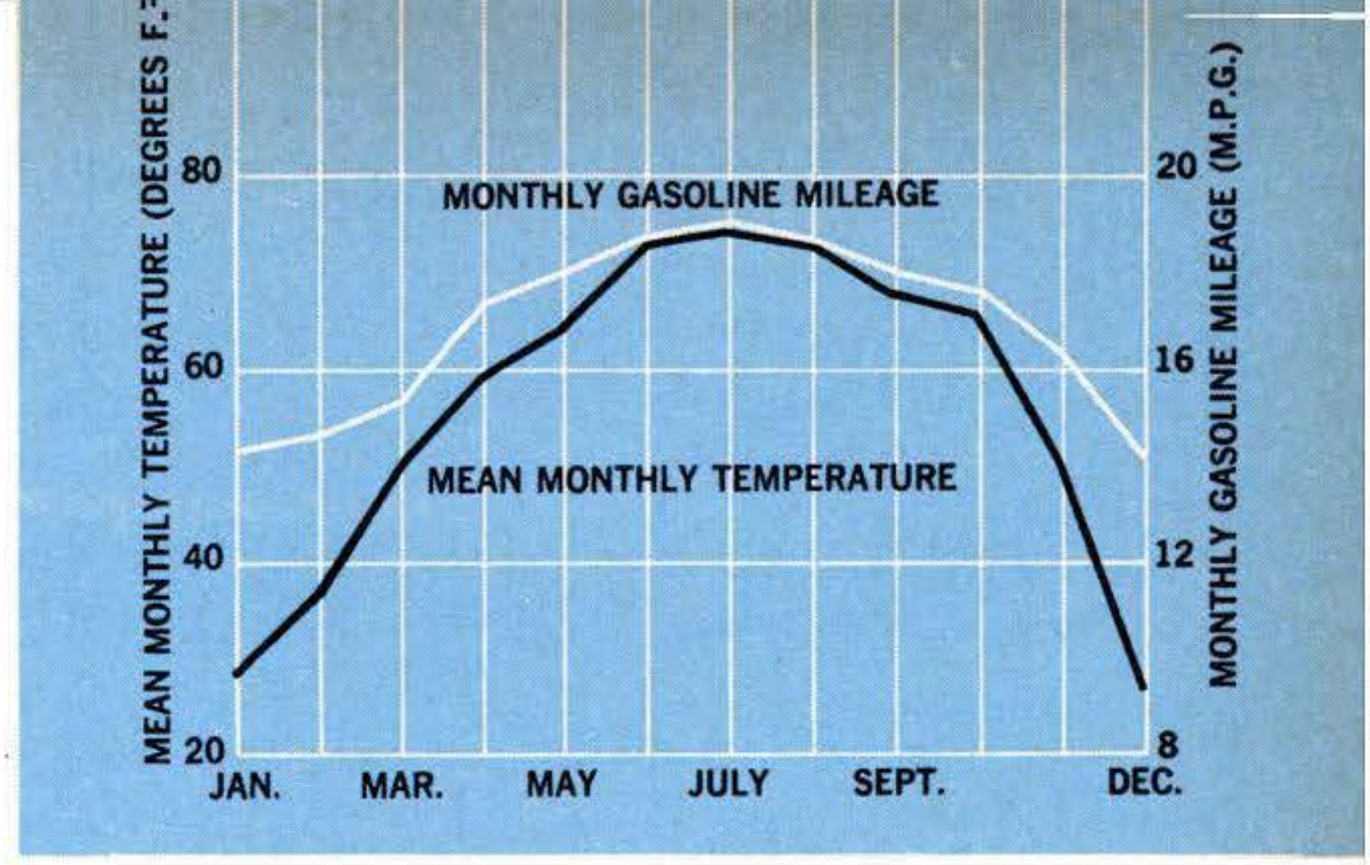
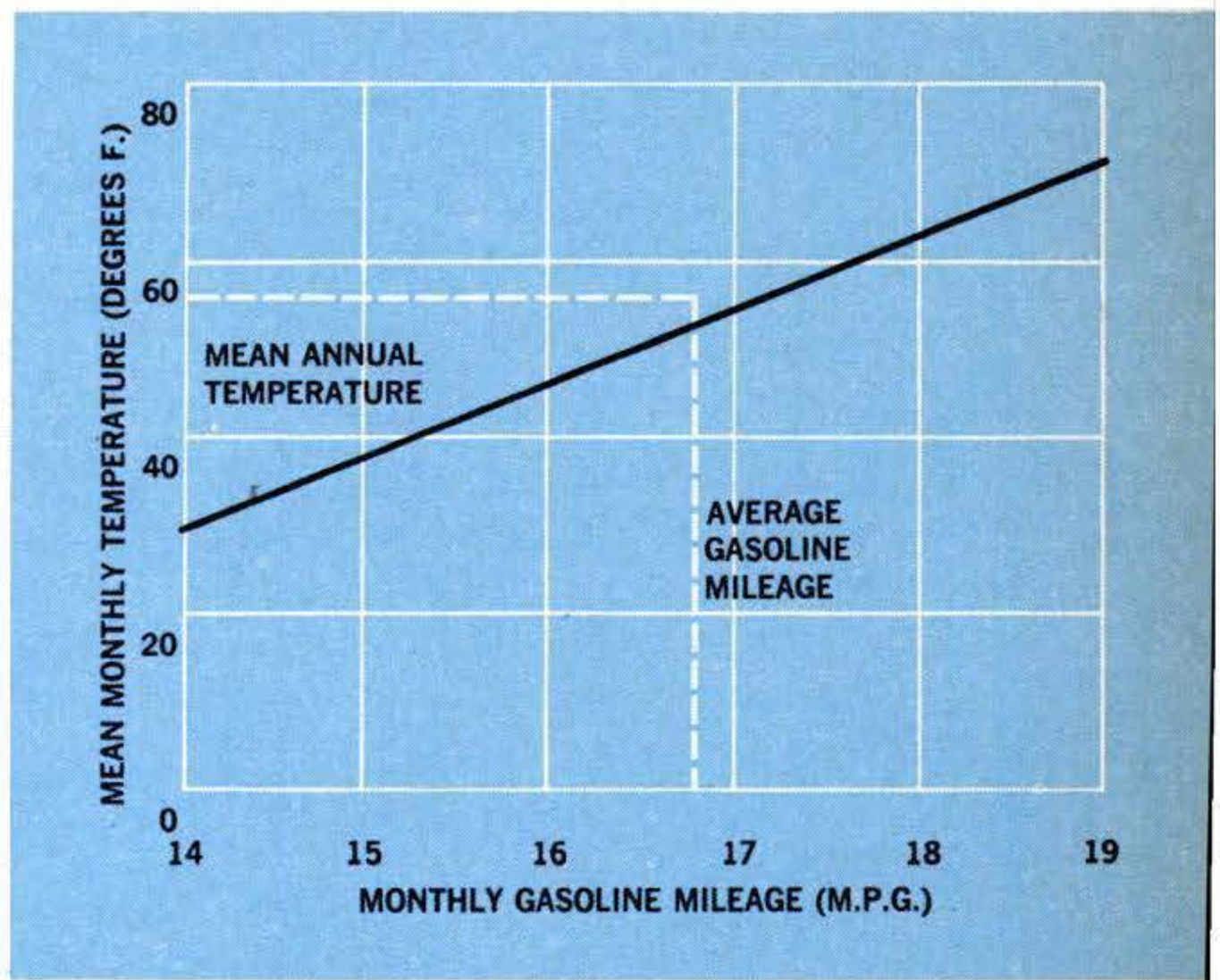




A car in top shape, properly tuned throughout the year, driven day after day for several years over the same route, shows an interesting fuel-mileage curve plotted against the mean monthly temperature. We can conclude some loss in gas economy is inevitable.



Linear curve for gasoline mileage related to outside temperature shows a practically constant ratio. The author was able to make accurate guesses of temperatures from fuel bills and odometer readings.

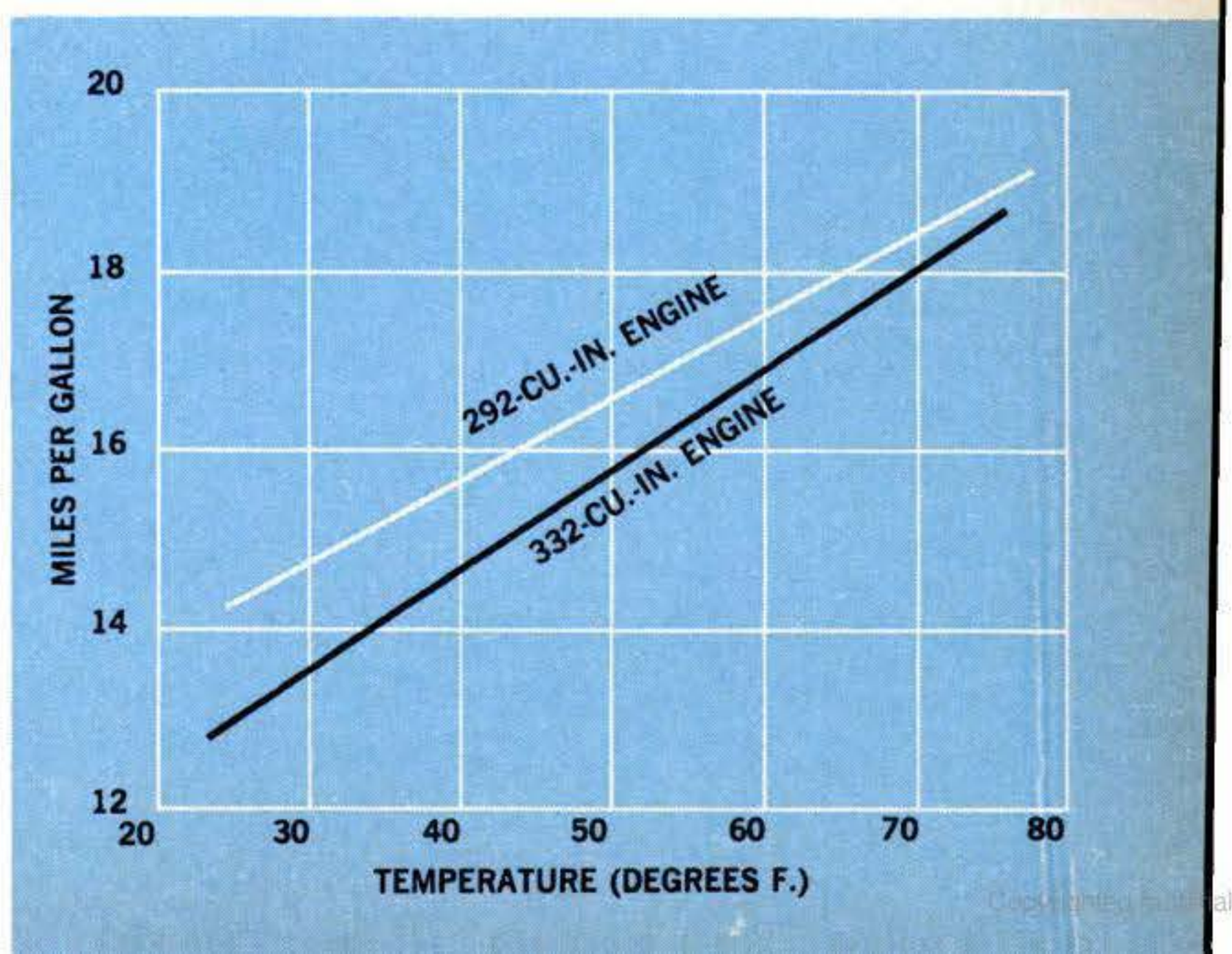
in the Winter?

grade oil. Multigrade oils with an improved viscosity index offer less friction and better economy in winter driving.

5. *Tire pressure.* In cold weather, tire pressure will be several pounds lower than in summer due to the thermal contraction of air. Soft tires increase frictional drag (rolling resistance) and cause a drop in gasoline mileage.

Finally, watch your driving. Wheelspin when you're accelerating in snow or slush means a complete waste of fuel. Maintain steady speeds wherever possible. Above all, let the engine get a quick warm-up, under load. Letting the engine fast-idle to operating temperature is direct waste of the fuel in your tank.

Two Fords of similar weight, both with automatic transmission, garaged in same location, driven the same route, show how the bigger engine wastes more fuel in cold weather than the smaller engine.



Gus Gets Off on the Wrong Foot

If that fool kid learned to drive properly, Mr. Attinger insisted, the brakes wouldn't grab — and would Gus please tell him so? No, Gus wouldn't

By MARTIN BUNN
ILLUSTRATION BY RAY QUIGLEY

"There's oil all over the engine," whined the voice on the Model Garage phone. "Come over and tow it in."

"Be there in 15 minutes," said Gus Wilson.

"Look for the Chevelle in the parking lot. I'll see you there," said the voice.

As Gus hung up, Stan, his assistant, burst into the office.

"I thought Mrs. Allen was our kookiest customer, Boss. But the one I just had beats her. She wanted me to loosen the parking brake so it wouldn't smell if she forgot to take it off. Only a dame could get a wacky notion like that."

"Don't bet on it. I've heard some wilder ideas about cars than that."

"Huh! Show me a man with one to match this, and I'll buy you a lunch."

As Gus turned into the parking lot of a small, modern plant, he recognized a 1965 Super Sport Chevelle. Its owner, Peter Attinger, had been in for a tune-up recently. Gus maneuvered the truck behind the car.

"Come look at this," said Attinger in a high, unpleasant voice.

Gus followed him. The car hood was up. Its 327-cubic-inch V-8 looked as if somebody had emptied a bucket of oil on it. The block, firewall, and hood underside were coated. A puddle had dripped onto the paving, and Gus smelled the rank odor of burned oil.

"It was so hard to start this morning I had to send for a booster battery," said Attinger, a paunchy man with big jowls. "It finally ran, but the engine had no power and stalled at every light. Finally I got on the turnpike and booted it to 65. After a couple of miles there was this smell of burning oil.

"I had to get here for a conference, and my gauges showed temperature and oil pressure okay, so I kept going. When I got here, there was smoke coming from under the hood, and after I saw this mess I thought I better not drive it. So I called you."

Gus pulled out the dipstick. It showed fluid well above the full mark. His nose told him it wasn't all oil.

"There's gas in the crankcase," he said. "You'd have burned a bearing if you had driven much farther."

"Well, haul it off and fix it," said Attinger. "My boy's coming to take me home in my wife's car. Here he is now."

A Valiant sedan had rolled into the lot. Its young driver headed for the Chevelle at a modest speed. But as he approached, his front wheels suddenly locked, bringing the car to an abrupt, skidding halt.

"That fool kid! I've told him to use his right foot," shrieked Attinger.

A teen-ager got out of the car. Slender,

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As the young driver approached, his front wheels suddenly locked, bringing the car to an abrupt halt.

with high cheekbones, he didn't look much like his father.

"There's something wrong with the brakes, Dad. Mother noticed it, too, before that ankle laid her up. Just touch 'em, and they toss you into the windshield."

"Anything wrong with those brakes is your fault!" cried Attinger furiously. "I warned you not to use your left foot."

"I know, Dad. I have been using my right foot. But the brakes still grab."

"Because you ruined 'em." Attinger turned to Gus. "That car only has 6,000 miles on it. Brake lining doesn't wear out in 6,000 miles, does it?"

"No," said Gus cautiously. "But brakes can grab because of grease or brake fluid on otherwise good linings."

"Well, they don't grab when I drive!" shrilled Attinger. "Never mind. I'll come for my car this time tomorrow. Okay?"

It was too late to work on the Chevelle that day. Next morning, Gus inspected the breather cap. It didn't look as if the oil had foamed out there. The Powerglide transmission was full; so was the power-steering system. That left little doubt that the splashed oil had come out of the crankcase. But, Gus wondered, how?

Going by, Stan whistled at sight of the oil-soaked engine.

"I've finished that tune-up, Boss. I don't need to ask what to do next."

"Nope. But while you're cleaning it up, try figuring how gas got into the crankcase while engine oil went out."

Continued

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Stan set to work. When Gus next saw the engine, it shone. But Stan was puzzled.

"The gas part's easy: a ruptured fuel-pump diaphragm. If enough gas gets into the crankcase to raise the level up to the pump, it might even shoot oil to the carb. But why all over the engine?"

"Let's yank the fuel pump," said Gus.

While Stan disconnected the fuel lines, Gus unscrewed a bolt to the right of the timing-chain cover. In its place he tightened a longer bolt to hold in the vertical push rod that worked the fuel pump. Gus removed the pump and took it to a bench.

"I cannot tell a lie, Dad. I did it with your chain saw."

After wiping off the last vestige of oil, Gus filed alignment marks on both diaphragm flanges and loosened the screws. Noticing a thread of oil on the casting, he wiped it away. It reappeared. Gus studied the jagged line of oil under a light.

"Find something, Boss?" asked Stan.

"A crack in the casting." Gus handed Stan the pump. "Probably it ruptured the diaphragm alongside it. That pumped gas into the crankcase, raising the oil level. It got so high the pump fed oil and gas to the carburetor, making the car hard to start. By yesterday morning the crack had opened enough, from heating and cooling a few times, to spray the stuff out. The gas evaporated, but the oil stayed."

Finding a replacement in stock, Gus installed a new pump, replaced the original bolt to plug the push-rod bore, and flushed out the carburetor. Stan drained the contaminated oil and refilled the crankcase. The engine started as soon as fresh gas reached the carburetor.

About four that afternoon, above the usual hum of traffic outside, there came a sudden squeal of brakes and the thud of bumpers. Gus wasn't surprised to see that Attinger's Valiant was the car in front.

The driver of the other car inspected both, shouted something conciliatory, and drove off. Attinger drove into the shop.

"The brakes are terrible!" he whined as he got out. "I tried to slow down for turning. They almost banged me into the windshield, and that tailgater hit me. I want them looked after right away. How about my other car?"

Gus showed him the cracked fuel pump.

"That's the factory's fault, I guess," muttered Attinger. "But these brakes are something else again. My boy's taking a bus here to drive one car home. When he comes, you tell him how he ruined the brakes."

"I'd have to be sure he did, first."

"He's been braking with his left foot. I'm no mechanic, but I know that's wrong."

"Where did you learn that?" asked Gus.

"In a taxi. It had automatic drive, and a sign on the sun visor: 'DON'T USE LEFT FOOT ON BRAKE. IT CAUSES GRABBING.' The driver told me they're supposed to brake with the right foot."

"That sign was a lie," said Gus flatly. "The left foot can't cause grabbing any more than the right. But a sloppy driver using his left foot may keep feeding gas with his right as he brakes. Chances are, that's why the sign in that taxi. With all kinds of drivers in the fleet, they want to avoid needless extra brake wear."

"Humph! I always use my right foot."

"Some of us do," said Gus, "because we started driving manual-shift cars. But car makers widened the brake pedal on automatics to let the driver use the left foot. Some experts use it only for backing—it gives hairline control. Others, including some taxi drivers, use the left foot all the time. In all-day traffic driving, they feel, it's less tiring than lifting the right foot off the gas every time. Also, in icy or slushy

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weather, there's no risk of slipping off the brake onto the gas, as there can be with the right foot.

"But you have to watch that one, to keep off the gas when braking. If you're driving both manual and automatic shifts, it's probably smart to stick to right-foot braking with both. But mechanically it makes no difference. If your son uses his left foot, I can't tell him it does."

Attinger reddened. Gus drove the Valiant up a service ramp, jacked up the front, and took off the left front wheel.

"No grease on that lining!" Attinger burst out triumphantly.

The lining was indeed almost new. Gus found the brake-cylinder boots innocent of leakage, the backing plate tight, shoes correctly positioned. He pulled the right wheel and found the same true there.

"So it *must* be using the left foot," cried Attinger. "Maybe now you'll tell my son."

Beyond Attinger, Gus saw the boy, who had come in unheard. His face was white.

"Your son just came in," said Gus.

Attinger acknowledged the boy with a grunt. Gus turned one of the wheels into the light to inspect the drum. It was dry, clean, and unscored. Inside lay a little heap of loose dust that fell to the bottom constantly as he turned the wheel. The other drum had an equal amount of dust in it. Gus flipped both wheels over, dumping the dust, then wiped the insides of the drums.

Covering the wheel spindles with a rag, he brushed all dust off the shoes, springs, and backing plates, lightly sanded the linings, and dusted them off. With calipers he gauged the inner drum diameter and adjusted the shoes of each wheel to it.

"Is that all you're going to do?" demanded Attinger as Gus lifted a wheel on.

Gus nodded, replaced the outer bearing, washer, and nut, carefully adjusted the latter, and installed a new cotter pin. After replacing the other wheel, he let the car down and asked Attinger to come along.

A first gentle application of brakes slowed the car smoothly. Gus then tried them at various speeds and pedal pressures. At no time did the brakes grab or pull.

"What was the trouble?" asked Attinger.

"That dust in the drums—some worn off the lining, some plain road dirt. As the wheels turned, it was distributed over the linings. When you braked, there were pinches of dust between drum and lining.

"Under those conditions, brakes don't hold well at first, so the driver puts on more pressure. As the dust is squeezed thin, more lining suddenly comes into contact—and grabs. Often the trouble starts in damp weather; the dust seems to absorb moisture and act like grease. Once there's enough dust, it acts the same on dry days. Your son had nothing to do with it."

Both men were silent all the way back.

After paying his bill, Attinger started to get into his car. He turned toward Gus.

"Thank you for the repair and the good advice." He swung toward the boy. "I was plumb wrong about the brakes, Eddie. Take the car home—and use whatever foot you think works best for you."

"Okay, Dad." The boy's face came alive. He looked at Gus with wordless gratitude.

"I sure owe you tomorrow's lunch, Boss," said Stan. That left-foot gag was as wacky as anything I ever heard."

"I'll settle for hamburger and coffee, if you'll lift *your* left foot," said Gus.

"Huh?"

"You happen to be standing on mine." PS

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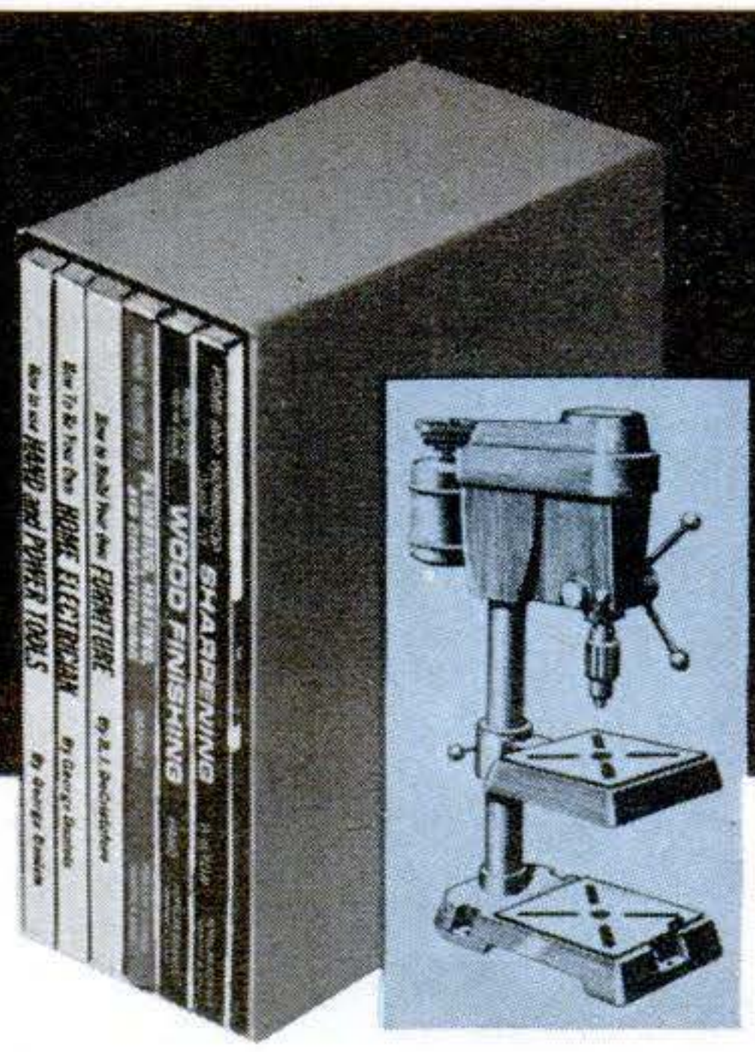

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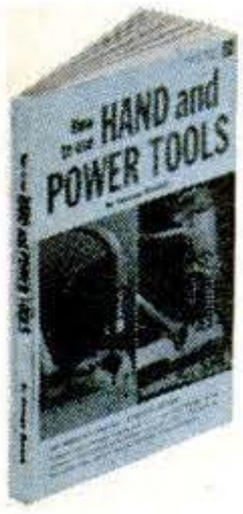

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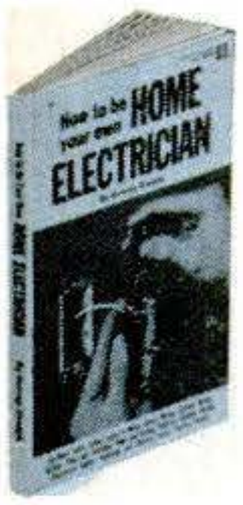

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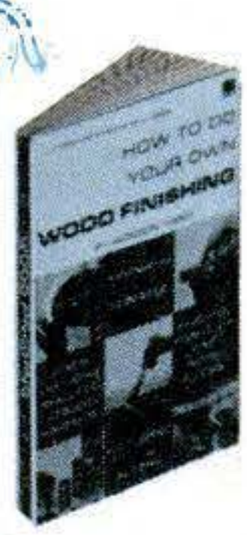

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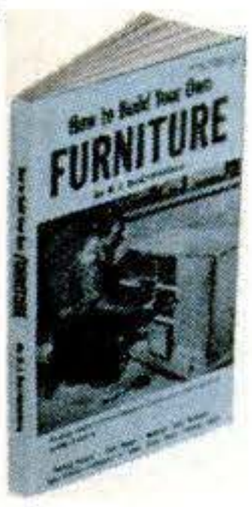

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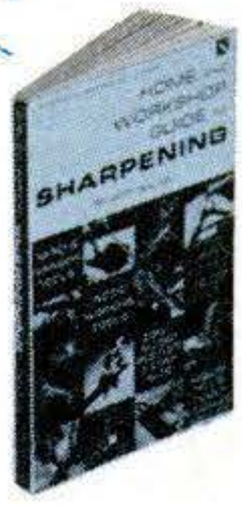

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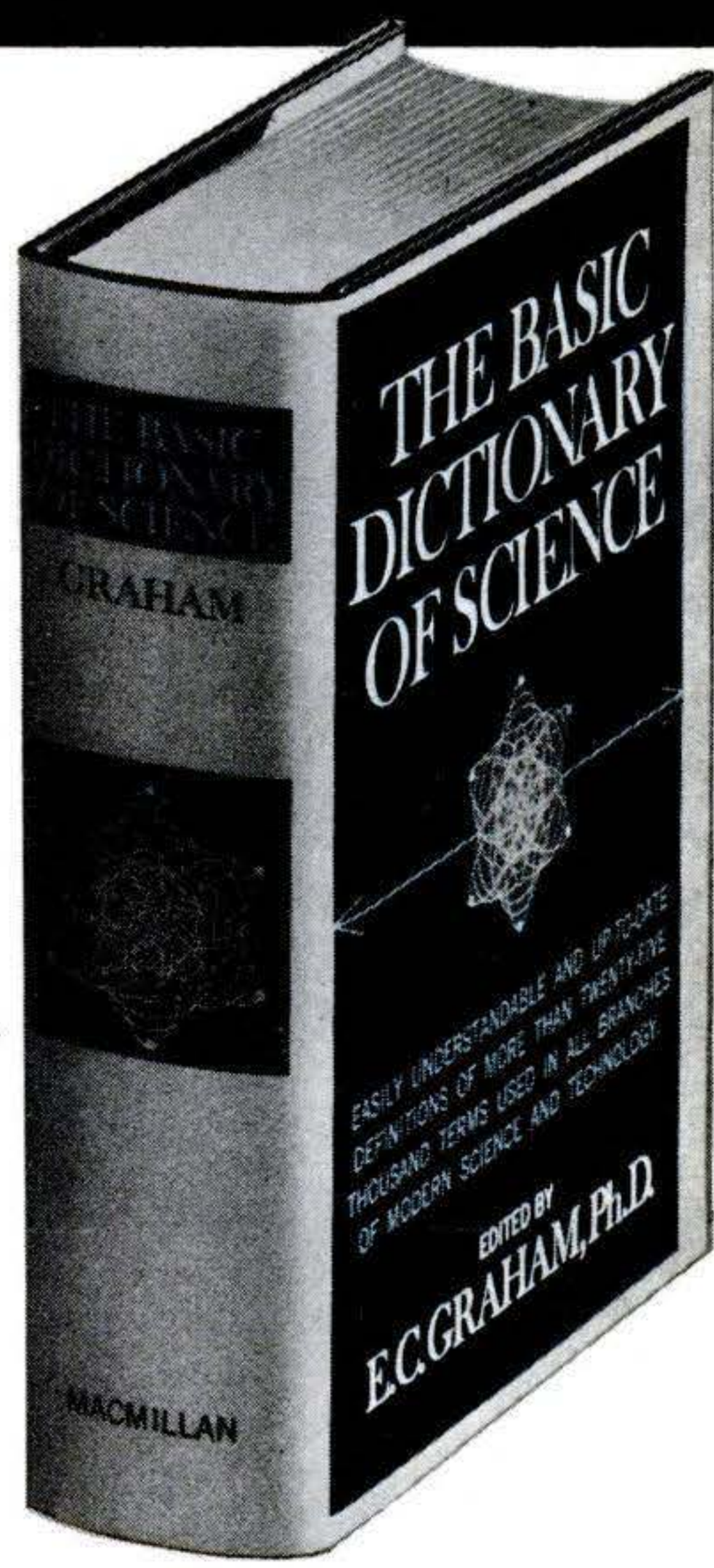

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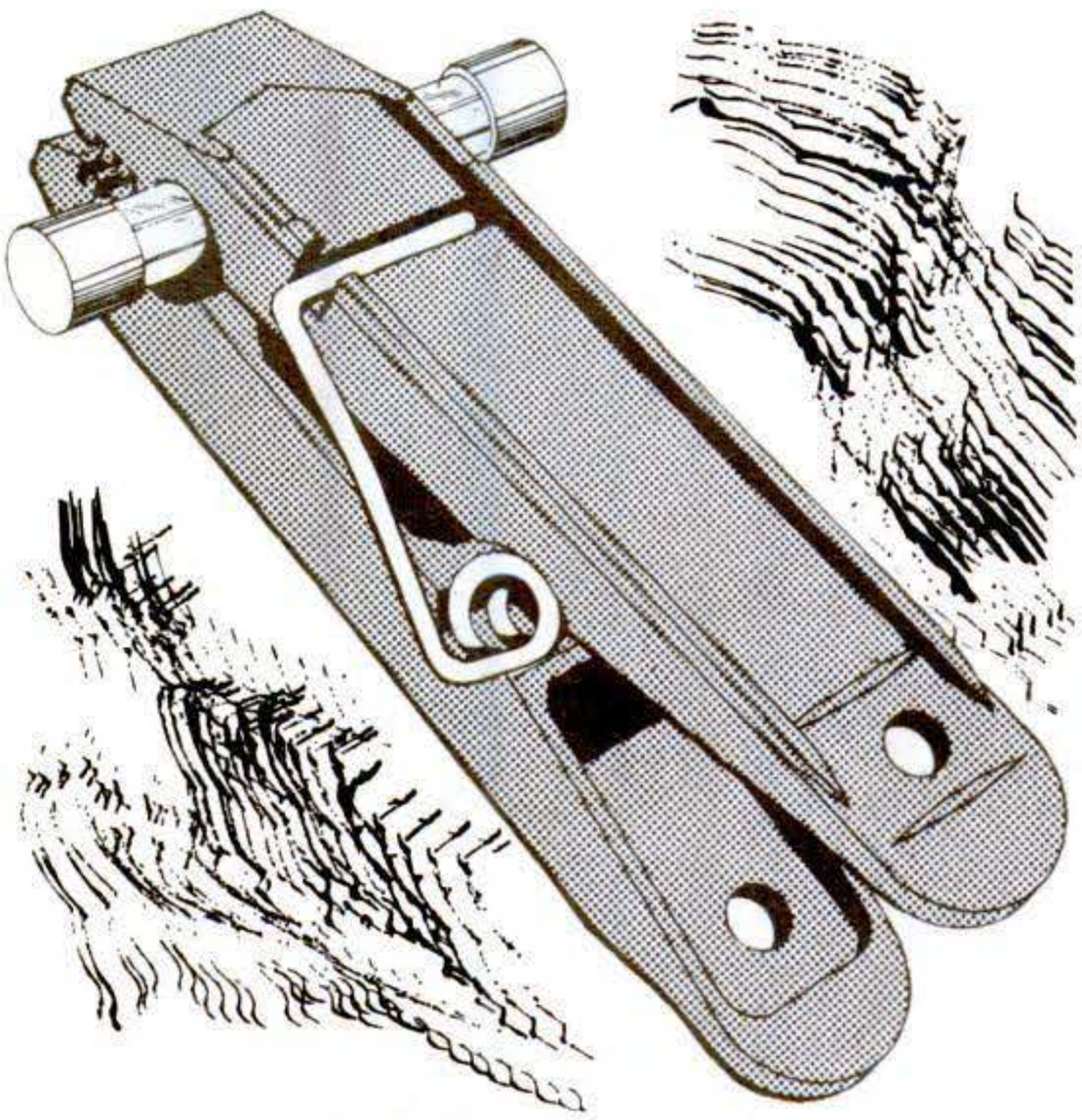
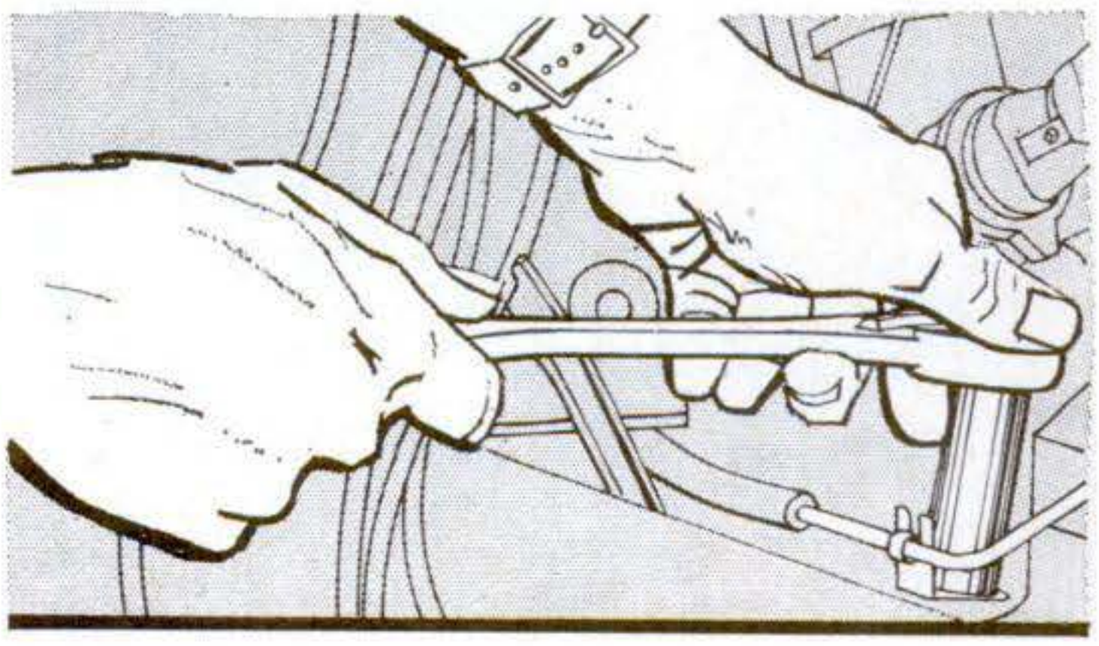
Hints from the Model Garage

DRAWINGS BY RAY QUIGLEY

When testing a radiator, an easy way to plug the outlets is to use sponge-rubber balls, which come in all sizes at dime stores. Find balls that fit the filler neck and lower tank outlet, and press them in to a watertight fit. Then place a tight-fitting rubber hose on the overflow pipe or on the drain cock. The hose should be long enough to let you blow into it while the radiator is immersed in water. You can build up about two-pounds' pressure in the radiator core by blowing. This will produce bubbles from a leak. Mark the leak, if any, and solder-seal it.



Burned-out headlight fuses can burn your fingers when you try to remove them. And your fingers don't even have a good grip. Instead, use a spring-loaded clothespin. It lets you remove and install fuses without breaking, arcing, or damage to fuse clips. You also save time.



When tightening cylinder-head bolts, keep wire clips and oil-line brackets, held in place by the bolts, from turning by putting a little coarse valve-grinding compound under the surface of each clip and bracket. They will stay in place right up to full tightening torque.

Continued

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Its new look is just one nice thing about the '67 Chevy pickup

THERE ARE LOTS OF OTHERS.

We got tough about new ideas to make it last longer . . . like eliminating exposed sheet metal joints on the cargo box. And building self-washing wheelhousings with special splash shields . . . new ideas to retard corrosion.

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Got the picture? So has your Chevrolet dealer. See him soon. Chevrolet Division of General Motors, Detroit, Michigan.

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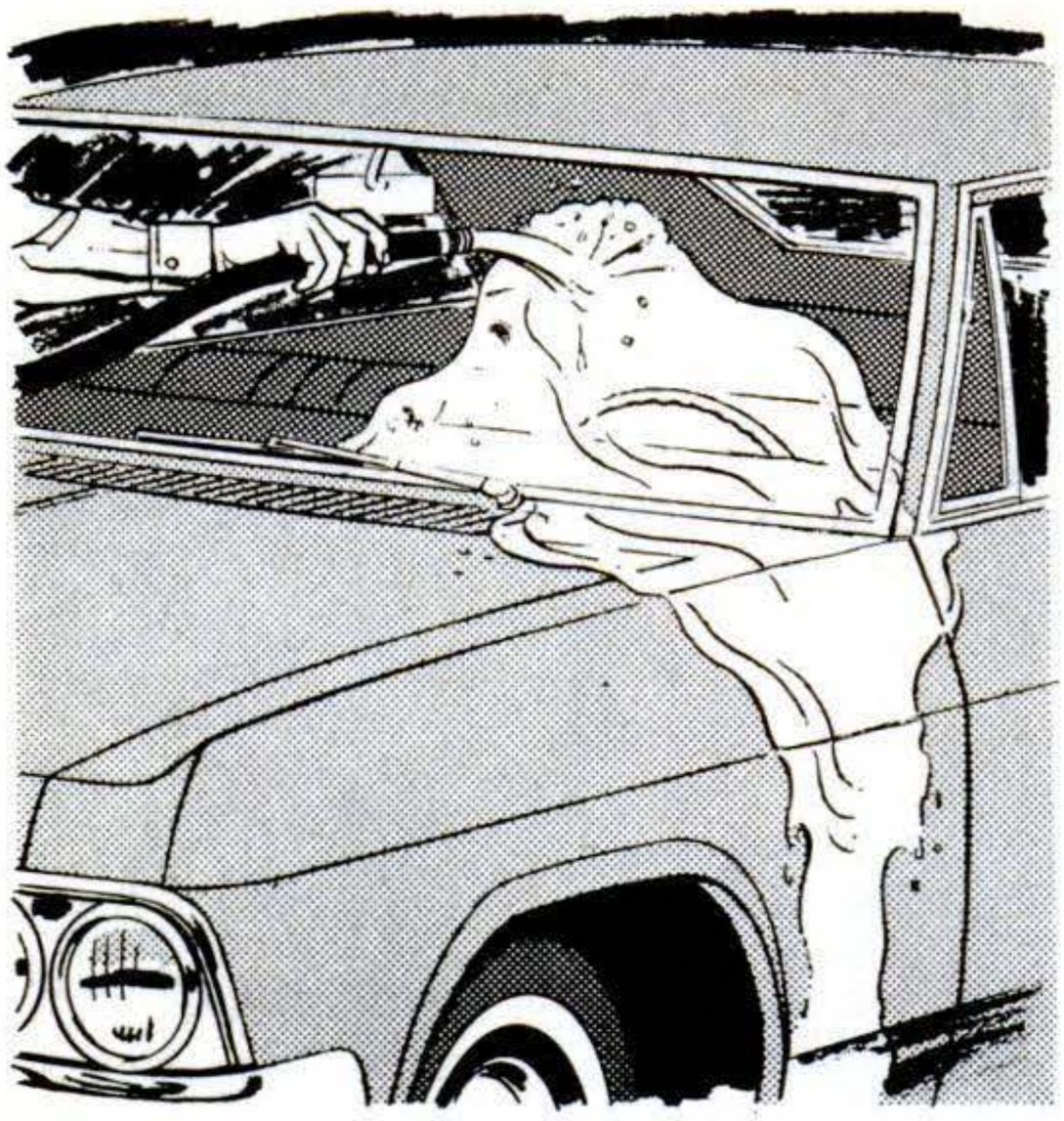
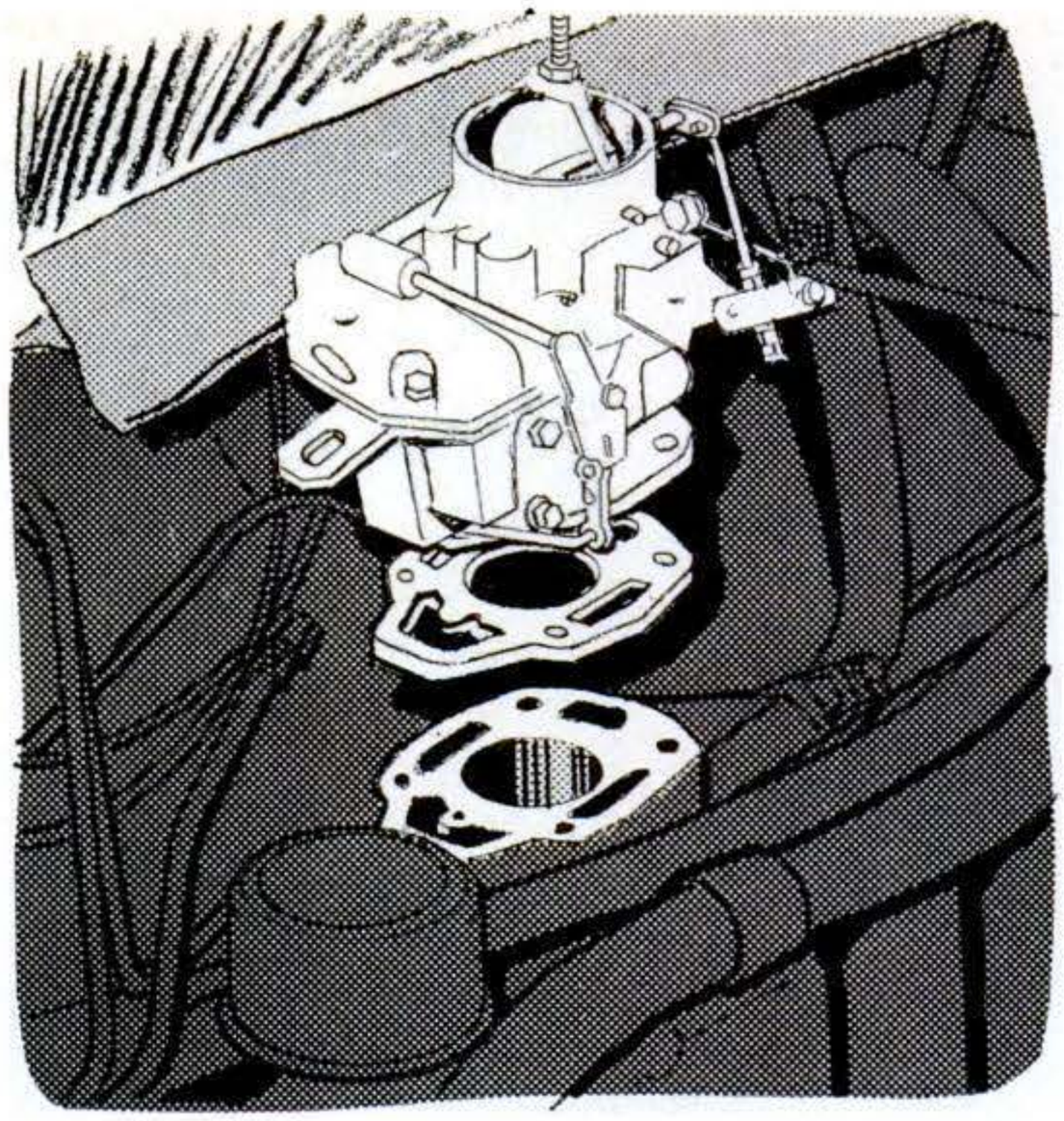
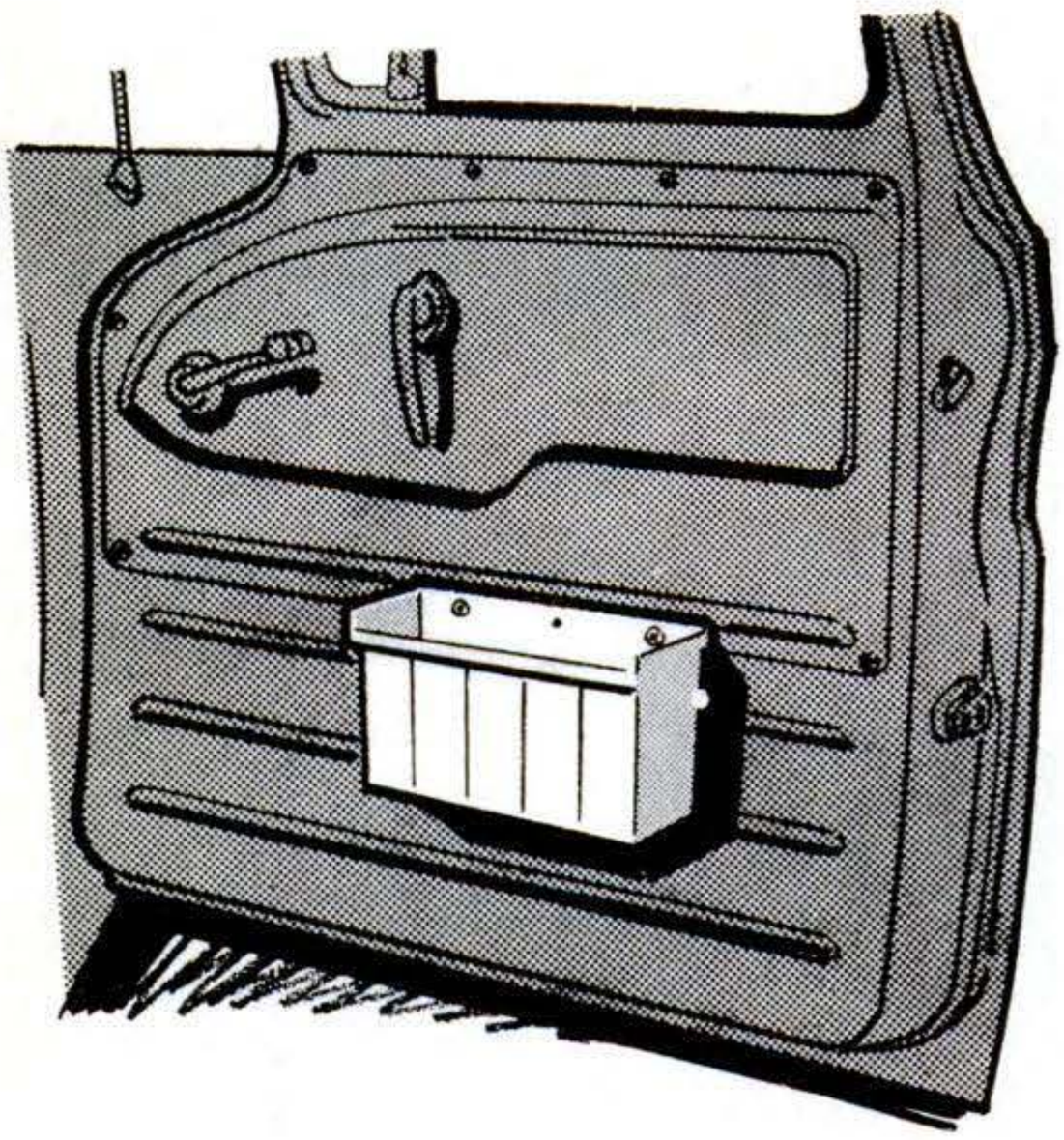
More Hints from theModel Garage



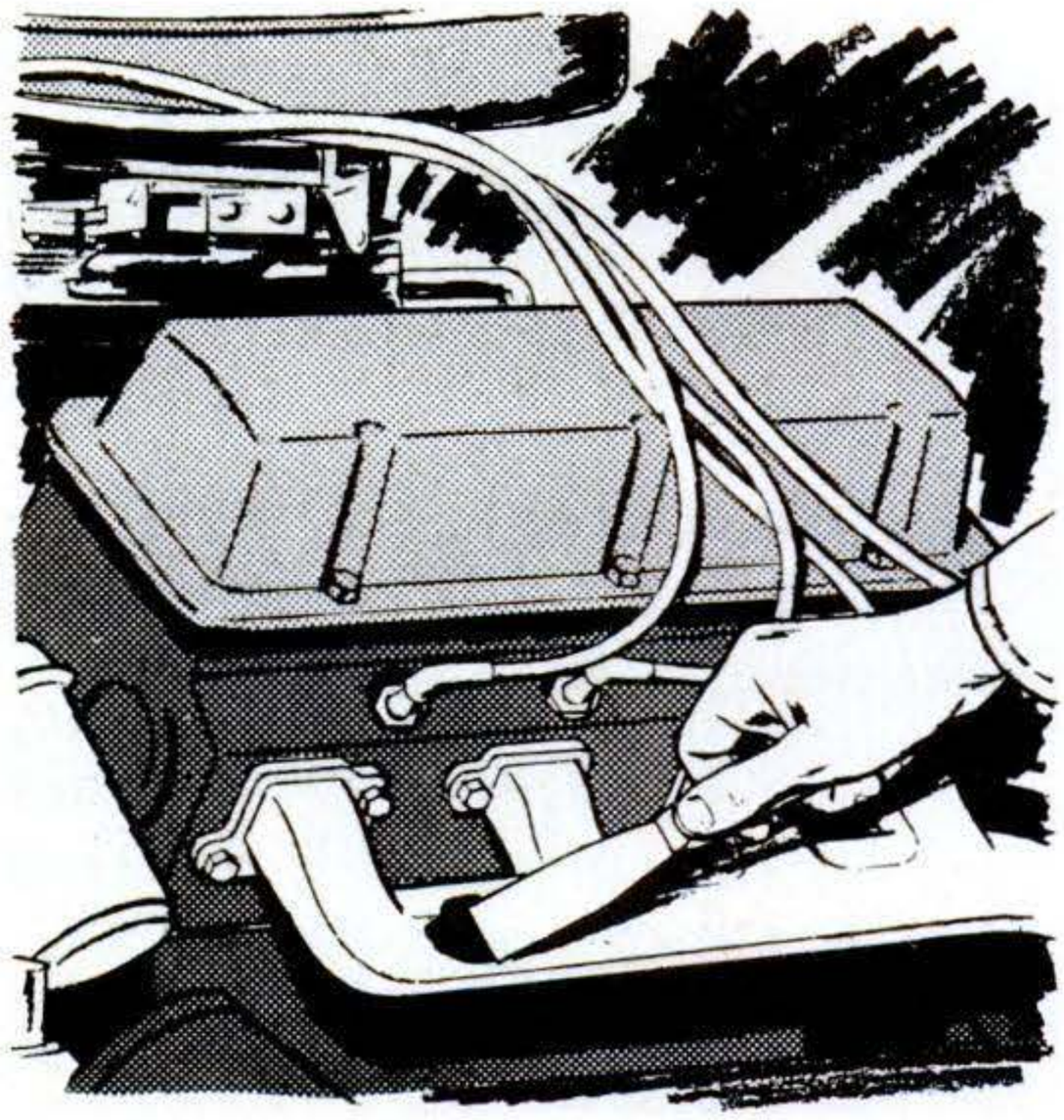
Check out water or air leaks in windshield, window, bolt holes, weatherstripping, by closing all windows and vents, turning on the heater-blower to high, and closing the doors. Run water in a small stream over the suspected area. Bubbles will show up where there are leaks.



If fuel boiling persists after you have checked your carburetor for proper float level and a good needle-and-seat seal, you may have to insulate the carburetor flange from the intake manifold. An insulating spacer (available as a spare part) will usually cure the fuel boiling.



Stowage space can get scarce in a pickup-truck cab, and in many cars, too. Plastic containers, readily available, can easily be fitted to the doors. Remove the screws from a door panel, add a washer for strength, and screw them right back on again through the plastic container.



Replacing a cracked exhaust manifold with junk parts can run up to $15, plus labor. With furnace cement, you can fix the manifold for a few cents. It's an asbestos product that can withstand tremendous heat. Dab it on, let it cure, and you have a seal that will last for months.

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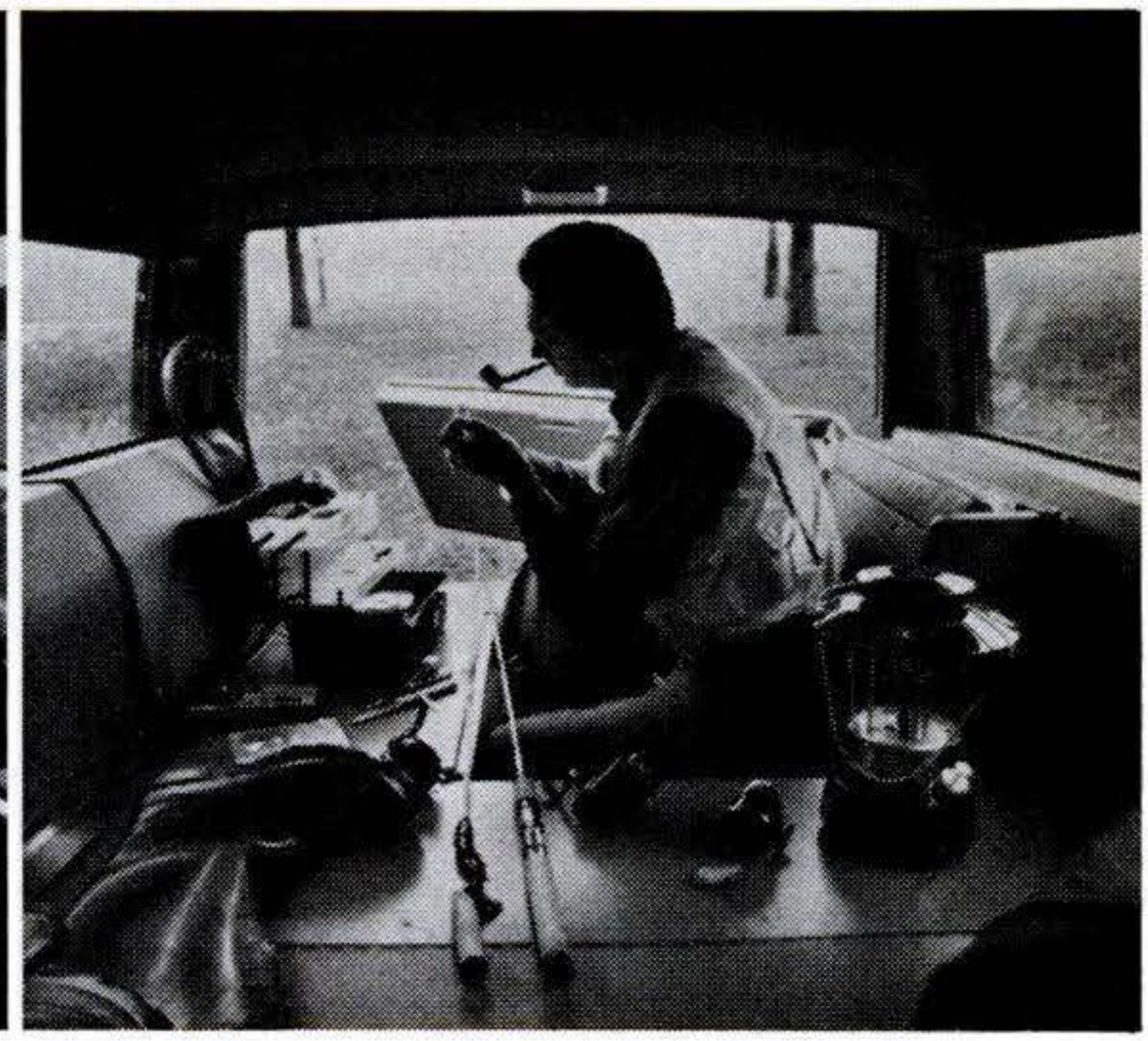

This man's wagon has a tailgate that turns into a door, and a hobby shop in the back.

Mercury figures that what happens in the back is pretty important to a wagon man. You want more than space alone.

So, first, we put an ingenious tailgate-door on this Colony Park. It swings down like a tailgate to load vacation gear. Or it swings open like a door to let you load heavy items without reaching across the tailgate. Spares your aching back.

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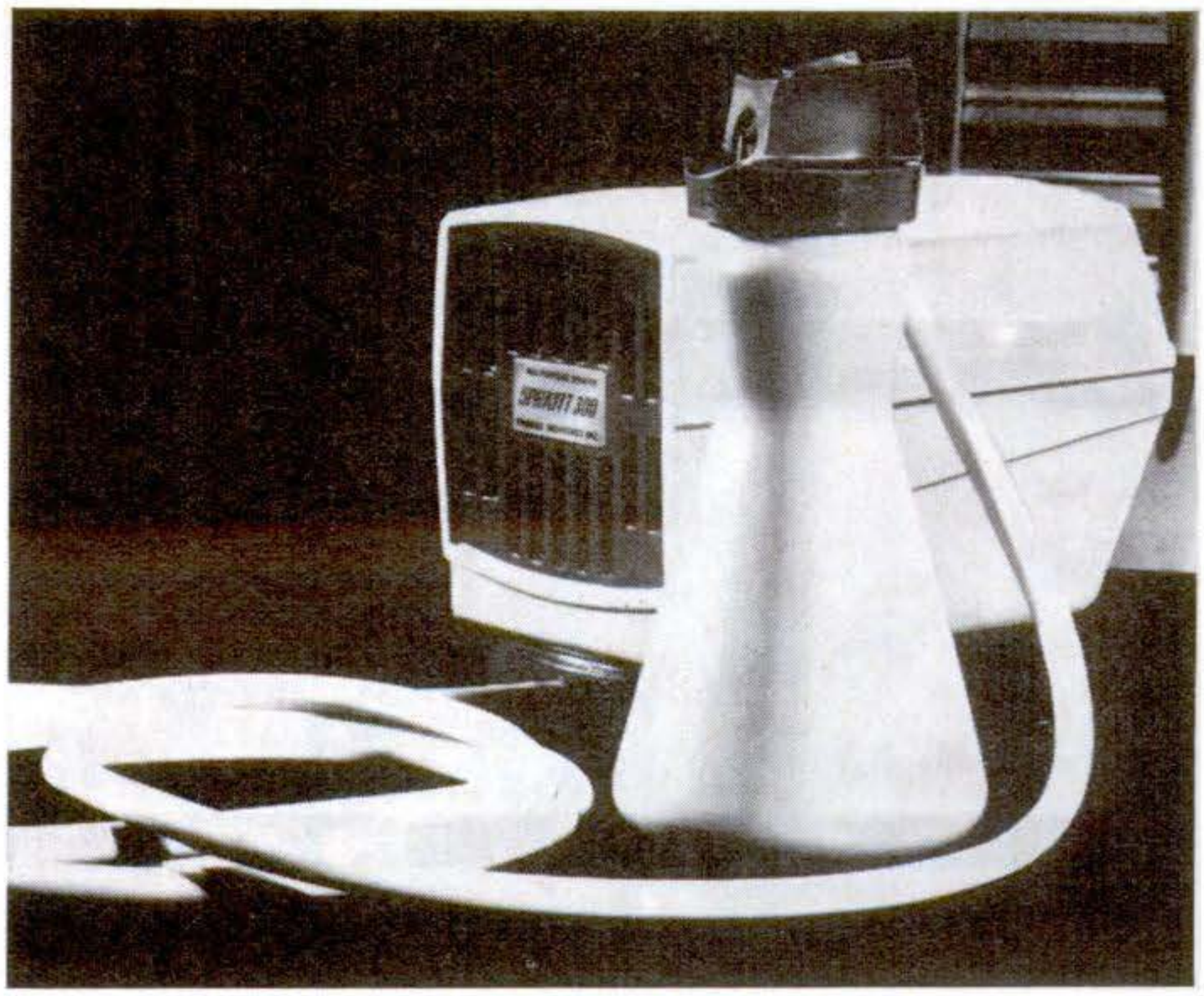
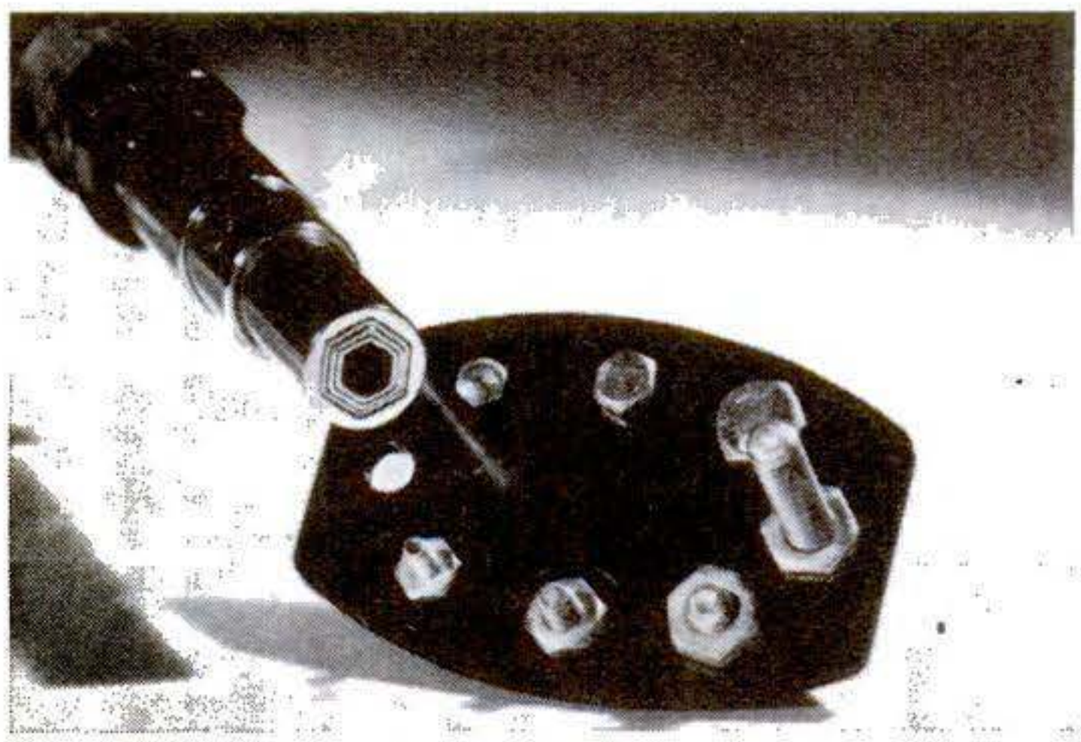
WHAT'S NEW

TOOLS

New all-purpose sprayer for household liquids

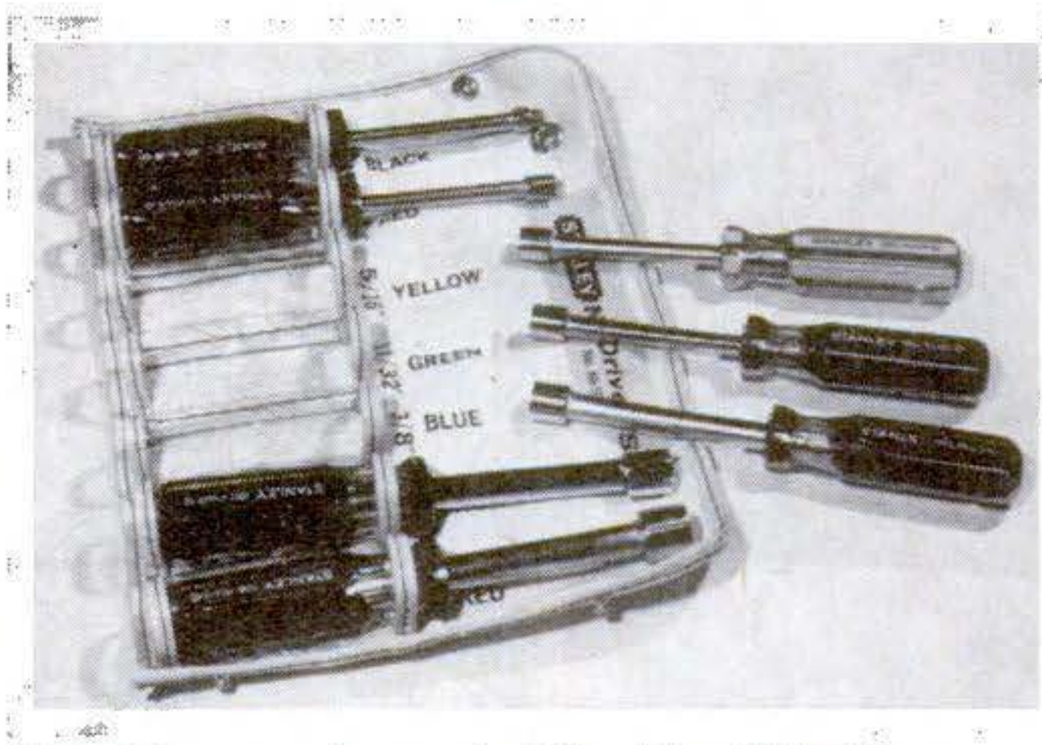
As stylish as any modern kitchen appliance, the new Sprayit 300 handles paints, insecticides, mothproofing, and waterproofing, as well as toy-inflating jobs. It's diaphragm-type motor-compressor is housed in a plastic case. The spray bottle is hourglass shaped for easy gripping. Thomas Industries, Inc., 207 E. Broadway, Louisville, Ky. 40202. $24.95.





Socket wrench adjusts to nut size

No need to search for the right-size nut driver. Here's a single tool that replaces a whole set. It's Montgomery Ward's new self-adjusting socket wrench and it can handle any nut between ¼" and 7/16". Just insert the driver over a nut, and a slight twist lets the right individually spring-backed insert slip over the nut. The versatile new socket wrench sells for about $6.

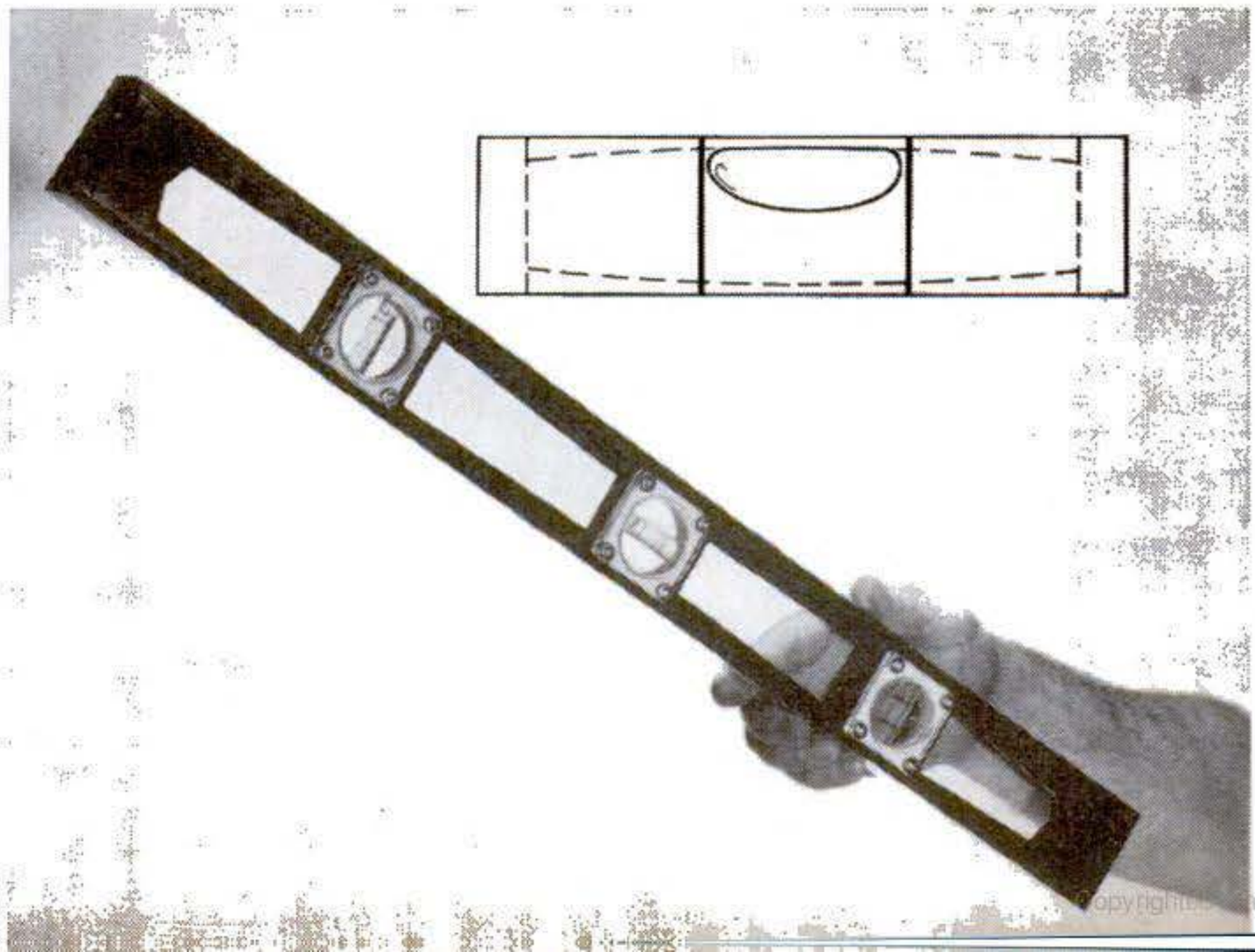


Nut drivers color-coded for identification

A quick glance at the handle color of these new Stanley nut drivers lets you pick the one you want out of seven sizes. The drivers also have hollow shafts that fit over long bolts, and chamfered sockets for fast fitting over hex nuts and bolt heads. You can buy the color-coded drivers individually, or the full set of seven, as shown in photo above, for $8.86.

Level has 360-degree vials

In Sears Roebuck's new Craftsman Mono-Vial Level, one bubble does more work than the paired ones found in regular levels. You get a reading regardless of which side or edge of the level is placed on the work. How does it work? Each vial is a plastic tube with a barrel-shaped curve machined on the inside. The bubble centers in the vial no matter which side is placed on a level surface. The 24" aluminum level sells for $6.99.



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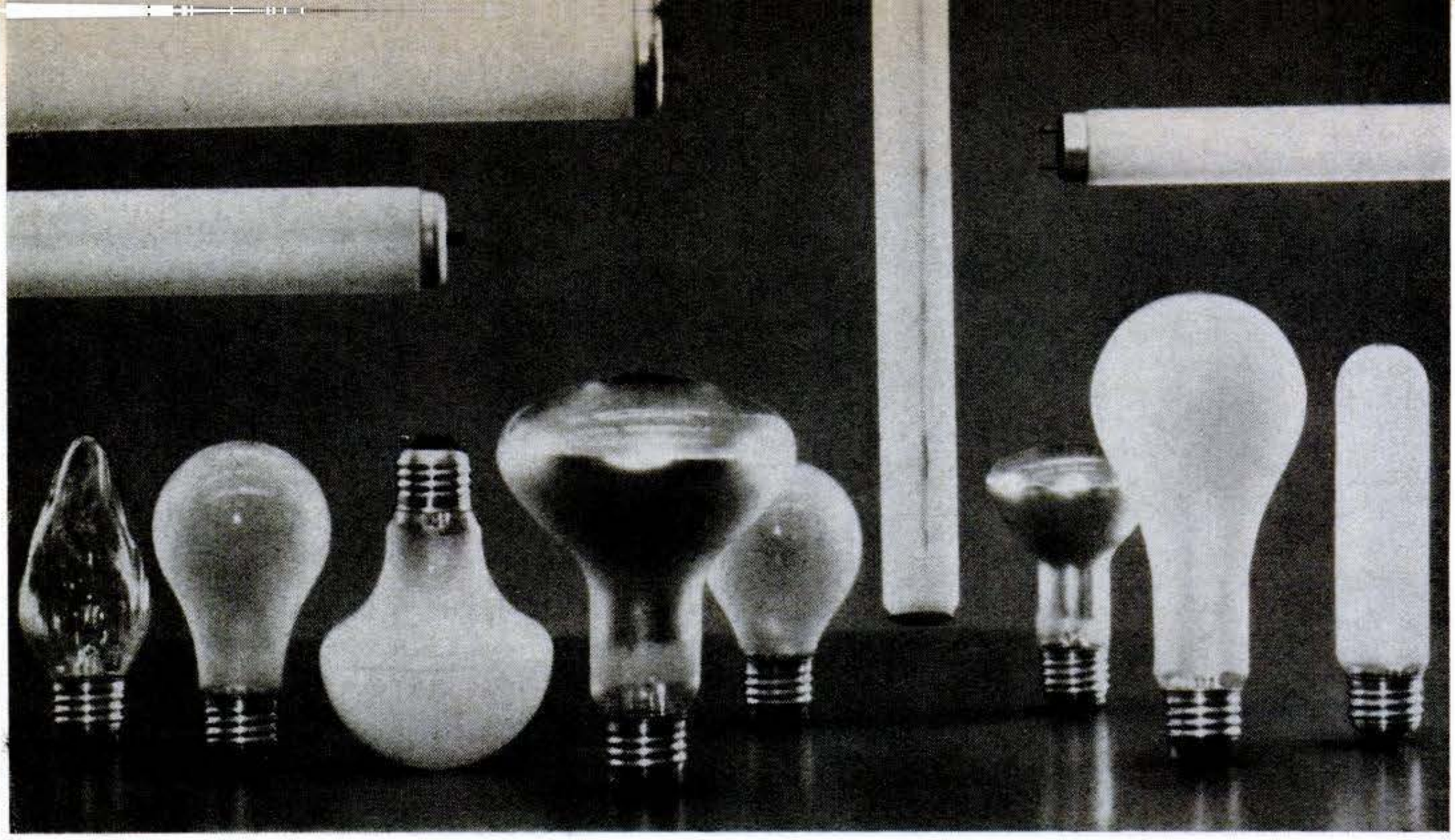

21 Good Questions About Light Bulbs

The answers will help you choose the right bulb for each socket—and save you money, too

By C. P. GILMORE

1 ***Some manufacturers claim their bulbs last three or four times as long as regular bulbs made by big companies. Do they?***

Yes. The standard bulb you buy is designed to last 750 hours. The long-life jobs really do go for the 2,500, 5,000, or even 10,000 hours claimed.

2 ***Then it's true that the big companies could make bulbs that would last a lot longer if they wanted to?***

Yes—in fact, they do. GE, Westinghouse, and Sylvania—the big three—all make long-life bulbs in addition to their regular lines.

3 ***Then I can save money on bulb replacement with long-life bulbs?***

On bulbs, yes. A regular bulb costs about a quarter, a long-life bulb from 25 to 60 cents and lasts anywhere from three to 10 times as long. But you have to consider the operating costs as well as the first cost.

There's a basic law of physics: The higher the temperature at which an incandescent bulb operates, the more efficient it becomes. Also, the less time it lasts. Take this to an extreme and you get a flashbulb. It gives a fantastic amount of light and consumes only a few watts of power. But its life is a fraction of a second. At the other extreme is the ultra-long-life bulb. But the longer its life, the more it costs to operate.

Every light bulb design, consequently, is a compromise between efficiency and long life. The trick is to balance the two to get the most light for the least cost, considering both bulb and electricity costs. Here's how it works:

A standard 750-hour, 100-watt bulb produces about 1,640 lumens. In 750 hours, it generates 1.23 million lumen-hours (mlh). A lumen is a unit of measurement en-

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gineers use to determine light output at the source. One long-life bulb on the market lasts for 2,500 hours and produces 1,360 lumens. Over its lifetime, total output is 3.4 mlh.

The long-life bulb costs $8.09 to produce the same amount of light the standard bulb makes for $6.87, counting both bulb and electricity cost (at 3 cents per kilowatt hour).

The standard bulb would have to be changed twice. And if it's in a hard place to reach, it may be worth the extra money to avoid the chore. Ceiling lights in theaters and auditoriums, radio-tower lights, and others where the labor cost for changing can run to many dollars are equipped with long-life bulbs routinely. Even in a plant or office where an electrician's time for changing a bulb may run a dollar or more, the long-life bulb may actually save money.

4 ***Same go for fluorescents?***

No. First, by incandescent standards, all fluorescents are long-lived. They run anywhere from 10,000 to 20,000 hours—longer than even the most durable incandescents. Second, fluorescents work on an entirely different principle and are subject to different physical laws.

Fluorescents burn out because the coating on the filaments at each end eventually becomes depleted.

Various companies rate their fluorescents at different average lifetimes, but it's not easy to figure out the best buy. For one thing, light output varies widely from one type lamp to another. The GE 40-watt cool-white lamp, for example, puts out an average 2,900 lumens. But it's not a very pleasant color to use in the home. The deluxe warm white, which most people prefer, produces only 1,800.

Another problem: Claimed life ratings are usually based on a three-hour cycle—three hours on, off, then on again for another three hours. Run the same lamp on a shorter cycle and its life drops sharply.

To figure comparative costs of fluorescents, you must take into consideration the color you want, the cost of electricity, the cost of the lamp, operating conditions, and your operating habits. It's an almost impossible job.

5 ***Why are there so many kinds of lamps, both incandescent and fluorescent?***

There *are* a tremendous number. Each of the big three makes more than 10,000 different kinds. Many, of course, are special types: aviation, automotive, instrument, street lighting, Christmas tree. In any well-stocked home-lighting store there will be hundreds of different types.

6 ***No point in getting complicated in the home, though, is there?***

You *could* light your house with only 100-watt bulbs. But you'll get more and better light and spend less if you take advantage of the variety available.

7 ***Which ones do I use where?***

Use fluorescents for overall background light. They give a diffused, glare-free light that's ideal for general room lighting. The best way to use fluorescents is to install a wall bracket—strips of fluorescents along an entire wall a foot or two from the ceiling, hidden from direct view by a face board—usually a one-by-eight. Paint the inside of the board white, the outside to match the room. Light spills up to illuminate the ceiling, down to light the wall.

8 ***Then why do I need incandescents?***

A room lighted with fluorescents alone may have enough general light, but not enough for specific tasks—reading, game-playing, sewing. And it's flat looking. Incandescents are point-source lights that can be sprinkled around.

Generally, most incandescents used in the home will fall into two categories: the A-type bulb—that's the one you think of when somebody says "light bulb"—and the R or reflector bulb, a flood or spot. An A bulb goes into most table lamps and some fixtures; flush-mounted ceiling fixtures usually use R bulbs.

9 ***So I need 40-watt fluorescents, and A and R type incandescents. Is that all?***

They'll take care of 90 percent of your needs. But for special effects, use a few others, too. A 75- or 100-watt sky-blue bulb in a small reflector will make a dark-green plant sparkle. Small flame-shaped or teardrop bulbs wrapped with fiberglass or

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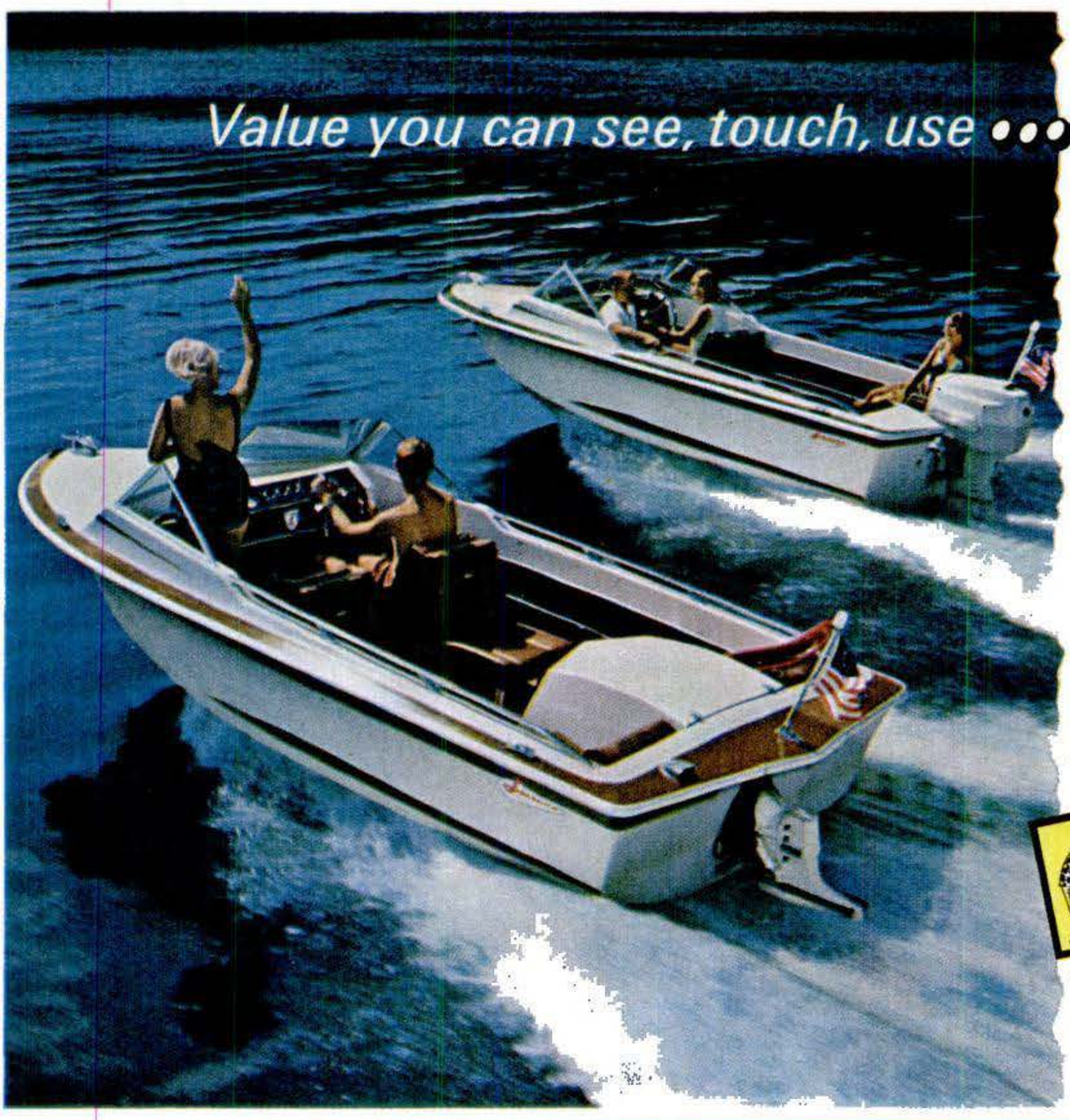

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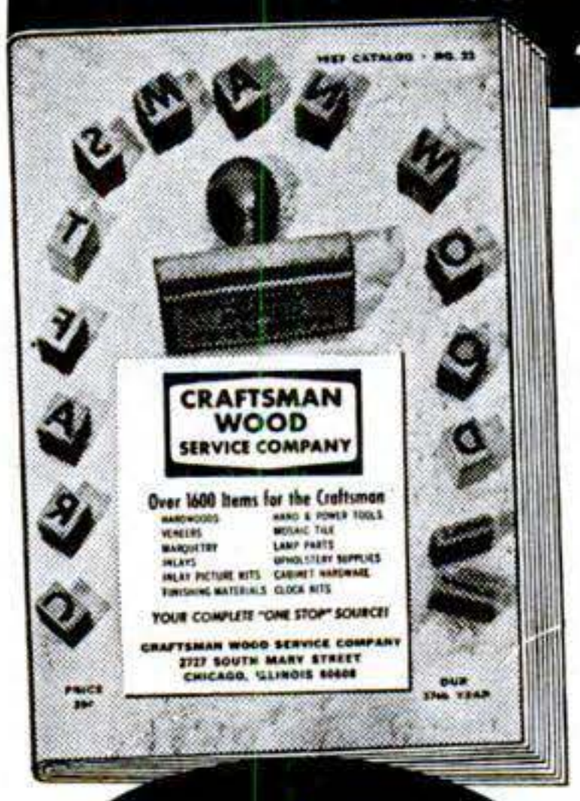

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etched with a special pattern give a flame-like, flickering effect. The new panel fluorescents—flat, 12-inch-square packages of light—are easy to put in a foot-square opening in the ceiling.

10 ***Aren't there some high-efficiency lamps on the market? Maybe I should use some of those, too, and save money?***

Not a good idea. There *are* high-efficiency bulbs such as mercury lamps and GE's new Lucalox lamp. Mercury is three to five times as efficient as the standard incandescent; Lucalox more than six times. But they've got drawbacks. Mercury, for example, isn't very efficient until it gets into pretty big sizes—say 400 watts. A 400-watt mercury lamp may give off 20,000 luments—as much as 11 or 12 standard bulbs of 100 watts. That much light concentrated in one package is fine for the ballpark, but you can't use it in your living room.

11 ***Okay. I'll stick with fluorescents. Any particular kind best?***

Yes. Whenever possible, use 40-watt tubes. These 48-inch tubes, an inch and a half in diameter, are available everywhere, are more efficient, and actually cost less than some smaller sizes. And if you use the same size everywhere, you won't have to stock different replacement bulbs.

12 ***Why does a fluorescent lamp need a ballast?***

A fluorescent is a negative-resistance device. That means the more current that flows through it, the lower its resistance becomes, which causes still more current to flow and the resistance to drop still further. If there weren't some device to limit current flow, the lamp would destroy itself in seconds. The ballast simply limits current flow.

13 ***What does the starter do?***

In the original type of fluorescent—the preheat lamp—the arc cannot be struck until the two small filaments at either end heat up and begin emitting electrons. The starter delays the application of voltage across the tube for several seconds until the filaments are hot enough. Small preheat lamps

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21 Good Questions About Light Bulbs

—such as those frequently used in desk fixtures—sometimes have no automatic starter. That's why you have to press the button, hold for a few seconds, then release to start.

Preheat lamps—except for special purpose and replacement in existing fixtures—are now virtually obsolete. New fixtures on the market use rapid starts.

14 *What are they?*

In the early 1950s, lighting engineers developed a tube with a filament that heats so rapidly that no starter is necessary. The arc strikes less than a second after the current goes on.

The rapid start has a number of advantages. First, it does away with the starter, making the circuit simpler and more reliable. It eliminates the waiting period—the light doesn't blink at you for several seconds. Also, unlike a preheat, a rapid-start lamp can be used with a dimmer. (Be sure to specify a dimming ballast if you plan to install dimmers.)

Most 40-watt lamps sold now are combination units; they'll work in either rapid-start or preheat fixtures. They operate more efficiently and last longer in rapid-start circuits, however, so make sure any fixtures you install are of this type.

15 *Why do fluorescent tubes come in so many shades of white?*

When the first fluorescents were built back in the late 1930s, their developers realized that the chemical composition of the phosphor coating—not the operating temperature as in incandescents—would determine the light color. So with their new freedom they set out to imitate the standard everybody accepts: daylight. It wasn't easy. For one thing, there is no agreement as to precisely what constitutes daylight color. It changes through the day. Spring light is somewhat different from fall light. The amount of moisture and dust in the air, the color of nearby buildings, the sea, the desert, and many other things tend to change the color of "daylight."

So designers picked a sort of northlight bluish version of daylight, highly prized by artists, and made the first fluorescents as close to that as possible. The trouble was that nobody wanted to live with them.

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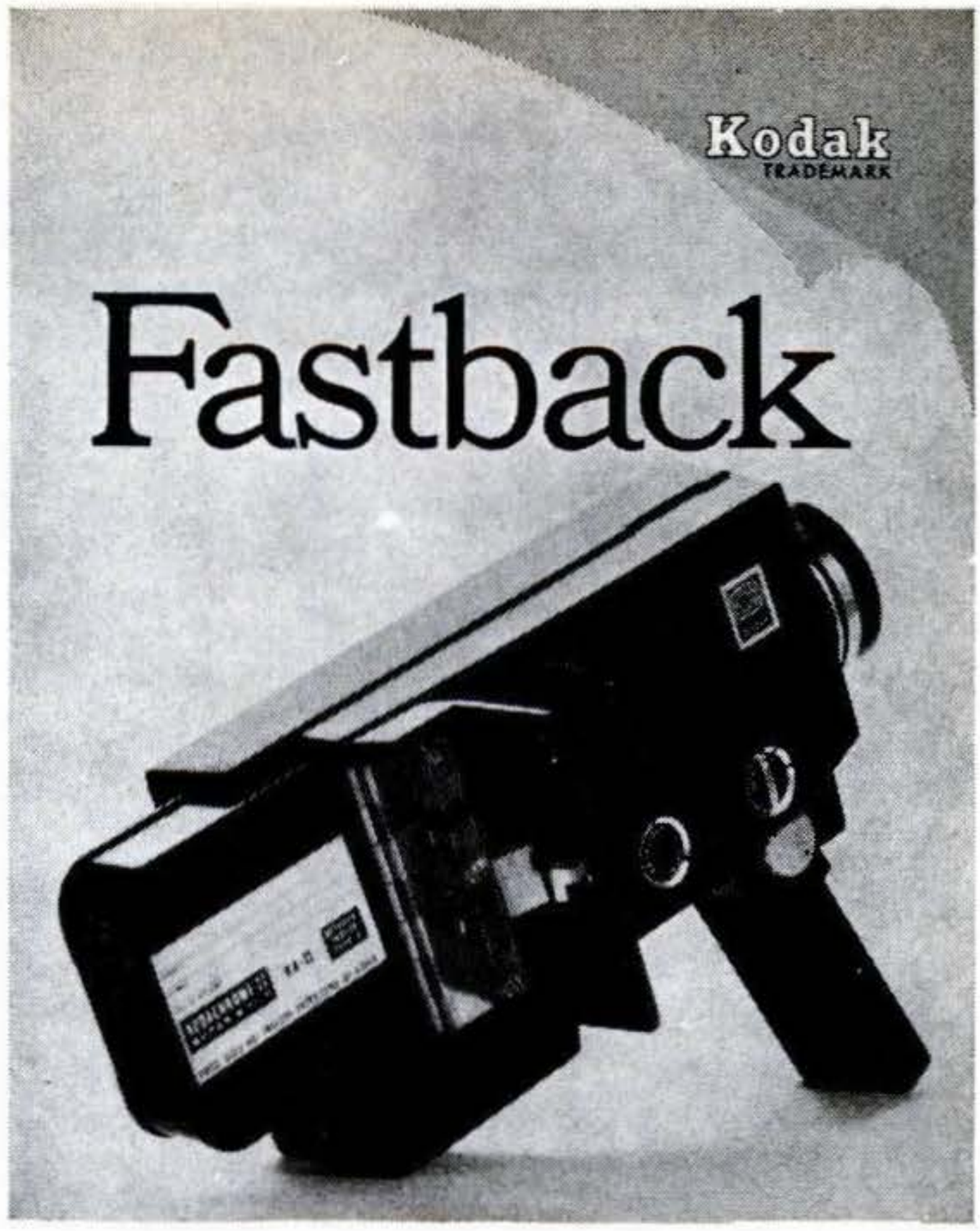

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They looked a garish blue at night compared with the familiar yellow incandescent hue. So manufacturers went back to the old mixing pot. In the years since, many shades of white have come and gone. Generally, most manufacturers have now settled on seven basic colors for home use.

16 *What are they?*

- *Daylight.* The original. Very blue. Makes people look as if they've got some rare tropical disease.
- *White.* Yellowish. Different from daylight but not much of an improvement.
- *Soft white.* Pinkish. Sort of boudoir glow. People look tanned and healthy.
- *Cool white.* Getting closer. Definitely on the bluish side, but appears fairly natural.
- *Warm white.* Designed to blend with incandescents, and it does. Yellowish tinge.
- *Deluxe cool white.* An improvement over cool white. Red added.
- *Deluxe warm white.* An improvement over warm white; more red.

Those are the main ones, but there are others. There's a special high-output white, for example, designed to get absolutely the most light out of every watt of electricity. And one company, Duro-Test, has gone back to the old goal of imitating daylight, but with a difference. Recently, the Bureau of Standards decided on which of the many colors of daylight would be considered standard. Duro-Test designed a new premium-priced fluorescent—Optima—that very closely approximates this daylight standard. Color rendition—the way colors appear under it—closely approximates the way they look in natural daylight.

17 *Which color should I use in my home?*

Most manufacturers recommend either the deluxe cool white (better color rendition) or the deluxe warm white (more like incandescents, hence more "natural-looking" to many people). These colors are preferable to most others because they're broader-banded—they don't peak all their light energy in one narrow part of the spectrum. Most people find this more balanced kind of lighting more pleasant.

Incidentally, when you go in to buy fluorescents, stick to your decision about colors. Many salesmen will virtually insist that you take white, warm white, or cool white because they put out the most light. They're trying to do you a favor by giving you the bulbs with the highest lumen output. They don't realize that you'd be better off with a lower output and a better color.

18 *Incandescents come in different colors, too, don't they?*

Well, not really, leaving out red, green, blue, and other decorative bulbs. The color an incandescent bulb generates depends on the temperature of the filament. The hotter the filament, the more blue and the less red and yellow the light. There's a practical limit, though, on how hot it can get. This maximum temperature—some 4,500 degrees—twice as hot as molten steel—gives the yellowish light we're used to.

There are two slightly different kinds of white light from incandescents. The standard frosted bulb, etched on the inside to provide diffusion, has been around for years. It diffuses the light, but there is still a bright spot in the middle. The newer so-called "soft-white" bulbs (don't confuse them with pink bulbs that are sometimes called "softlight") aren't etched; they're coated on the inside with silica powder. They give virtually the same amount of light, but the coating gives better diffusion and the bulb glows evenly over its entire surface. The lighting, consequently, is softer, more pleasant, and throws less shadow. Soft-white bulbs cost about a nickel more than regular ones.

19 *Any problem involved in using fluorescents and incandescents in the same room?*

Yes. The color of light put out by the two sources is likely to be quite different. If you can see the sources—the bulbs themselves—some fluorescents look unnaturally and unpleasantly blue; the incandescents, too yellow. The remedy is simple: Hide the sources.

20 *Is there any ideal amount of light?*

No, but there are some guidelines. When engineers talk about light, they use two principal terms: lumen and foot-candle. A lumen is the unit used to measure the light output at a source, such as a bulb. A standard 100-watt frosted bulb, for example,

Continued

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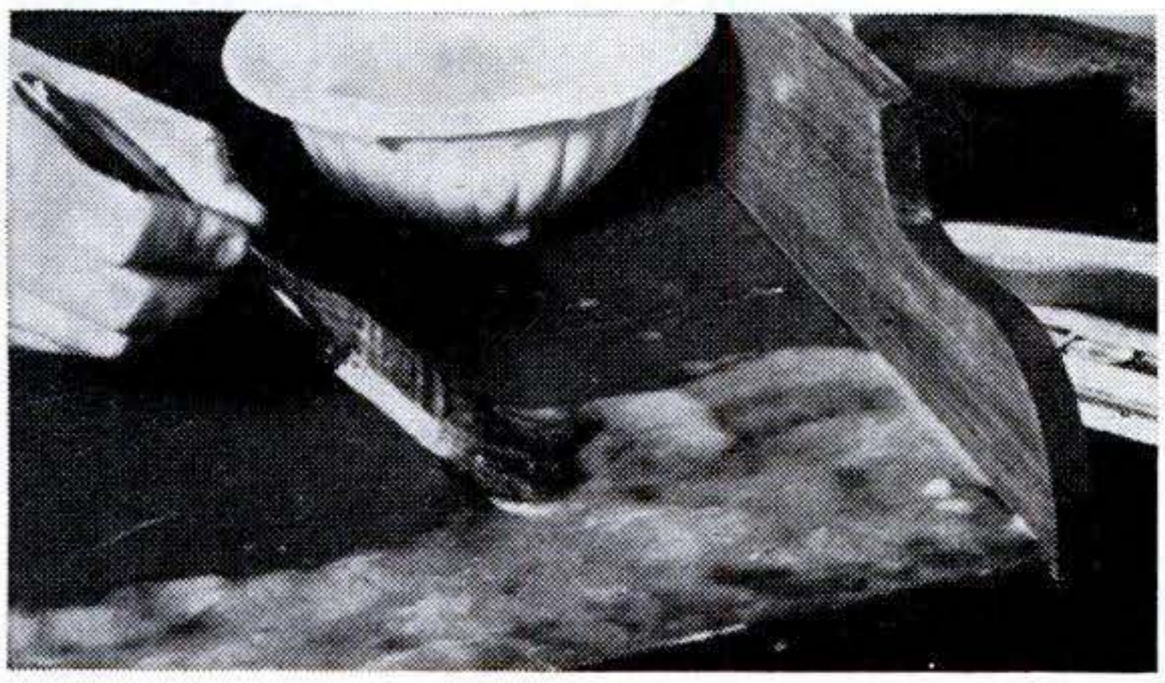

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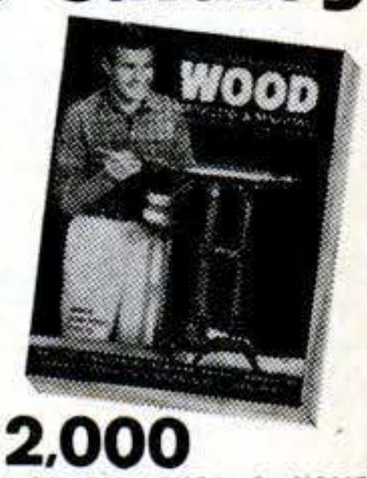

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A foot-candle is the unit used to describe the amount of light that falls on a surface. It depends both on the intensity of the source and the distance from it. A 100-watt bulb one foot above the surface delivers approximately 225 foot-candles to the surface; from a height of six feet, the foot-candle reading drops to eight.

Just how many foot-candles you should have depends on what you're doing. Most people find the following reasonable:

- Sitting around, talking, watching TV: 10-30.
- Reading, food preparation: 75-100.
- Shaving: 75-200
- Office work: 75-200
- Detailed work: at least 200.

Don't hesitate to hike these levels. Experts have found that the more light available, the less effort it is to see.

There is such a thing as too much light, but don't worry about it. The pleasant illumination under a tree in an open field on a sunny summer day is ideal for reading. It's almost 1,000 foot-candles. The only problem is contrast. If some areas are too bright, others too dim, the lighting will seem garish, uncomfortable.

21 *Do I save money by turning the light off when I leave the room, or would I be better off to leave it on?*

If you're talking about an incandescent, you'll save money. But you won't get rich. Suppose the room is lighted by two 100-watt bulbs. You go out for lunch one hour every day and turn the lights off. Over the period of a year, you'll save 365 hours of burning. The current you would have used would cost about $2.20, and since 365 is about half the normal life of a bulb, you will have saved the equivalent of one bulb. That's another quarter. All told, you'll pocket $2.45 during the year.

Fluorescents are different. Every time a fluorescent starts, its life is shortened. This has to be balanced against operating costs. There's a way to figure it, but the formula takes 10 different factors into account and an engineer to calculate it. Go by this rule of thumb. If you're going to be gone for more than 90 minutes, turn it off. If not, leave it on: The cost of the electricity will be less than the cost of the shortened life of the lamp. PS

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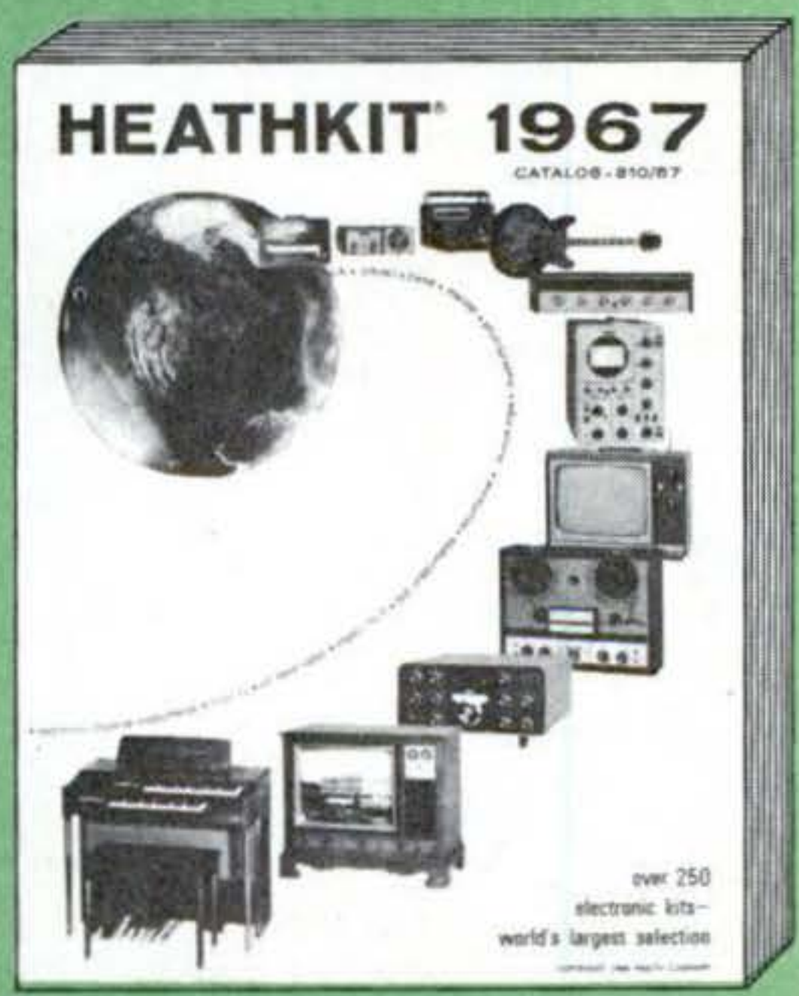

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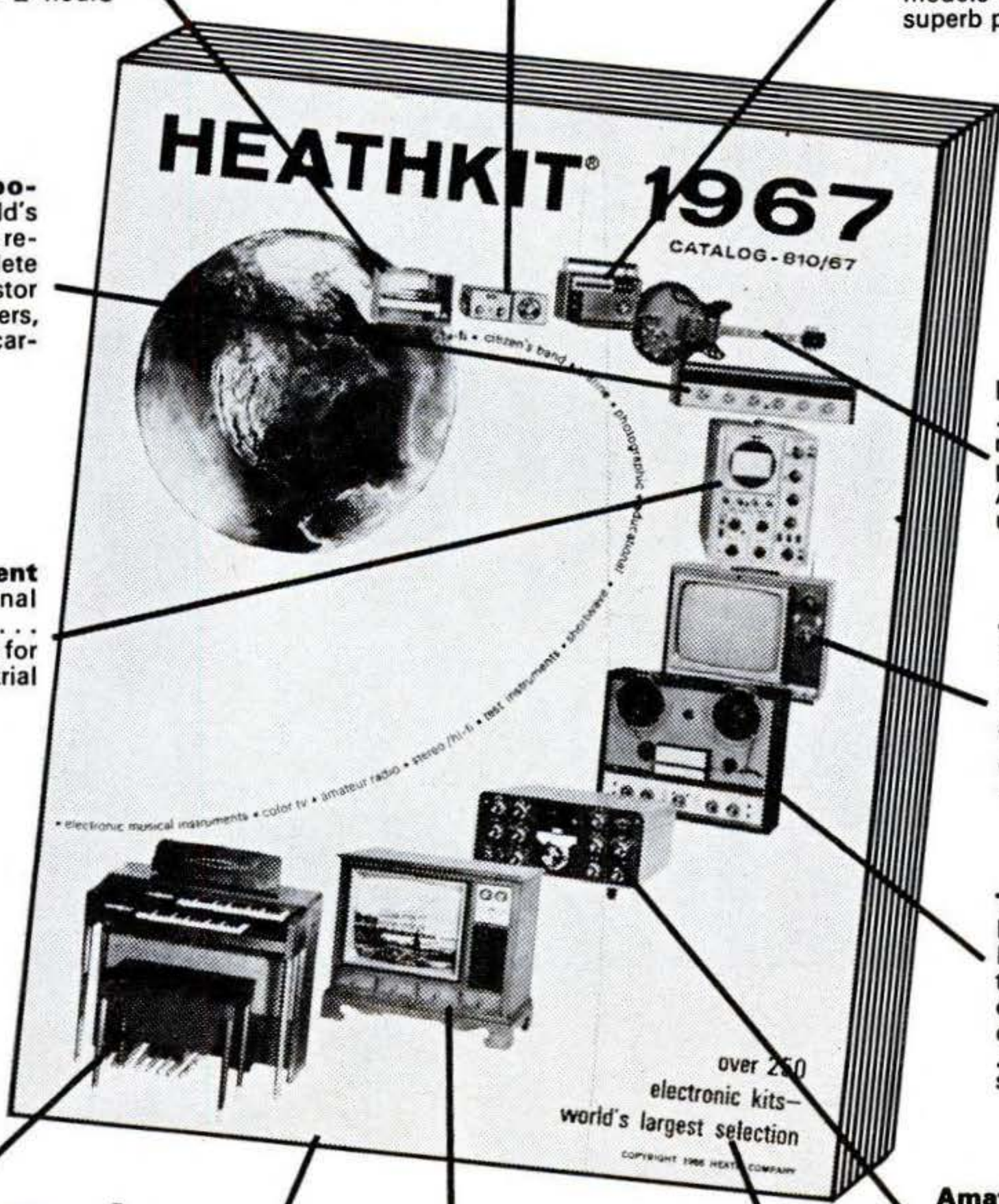

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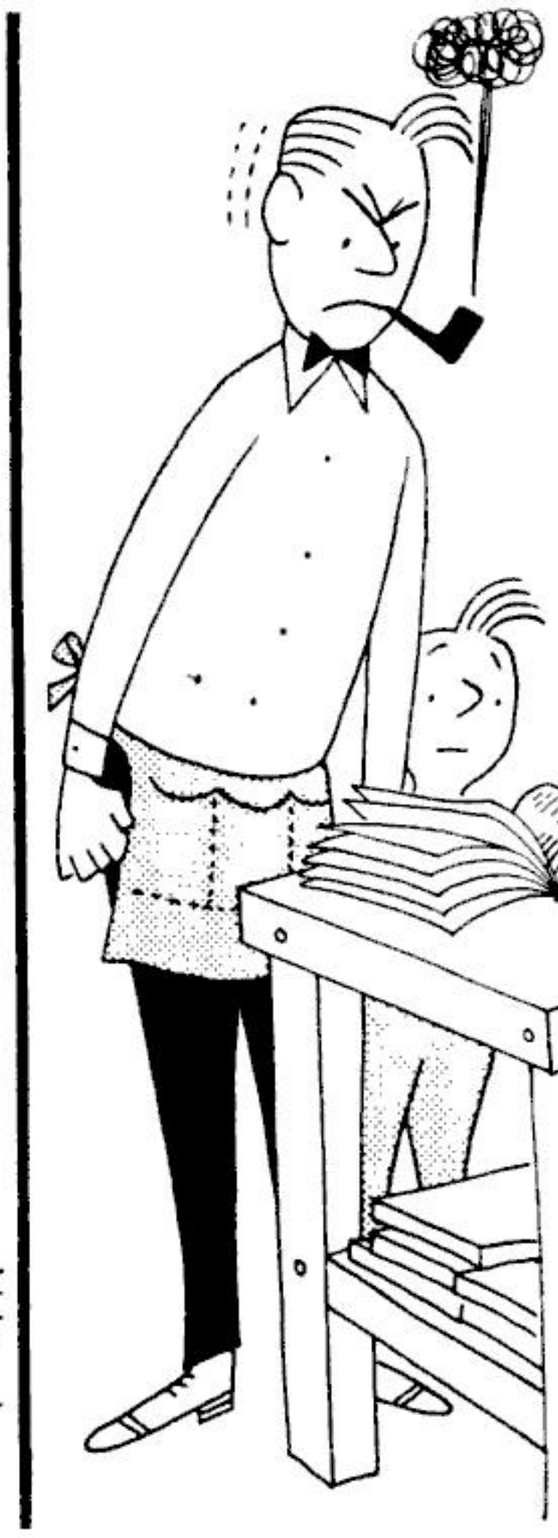

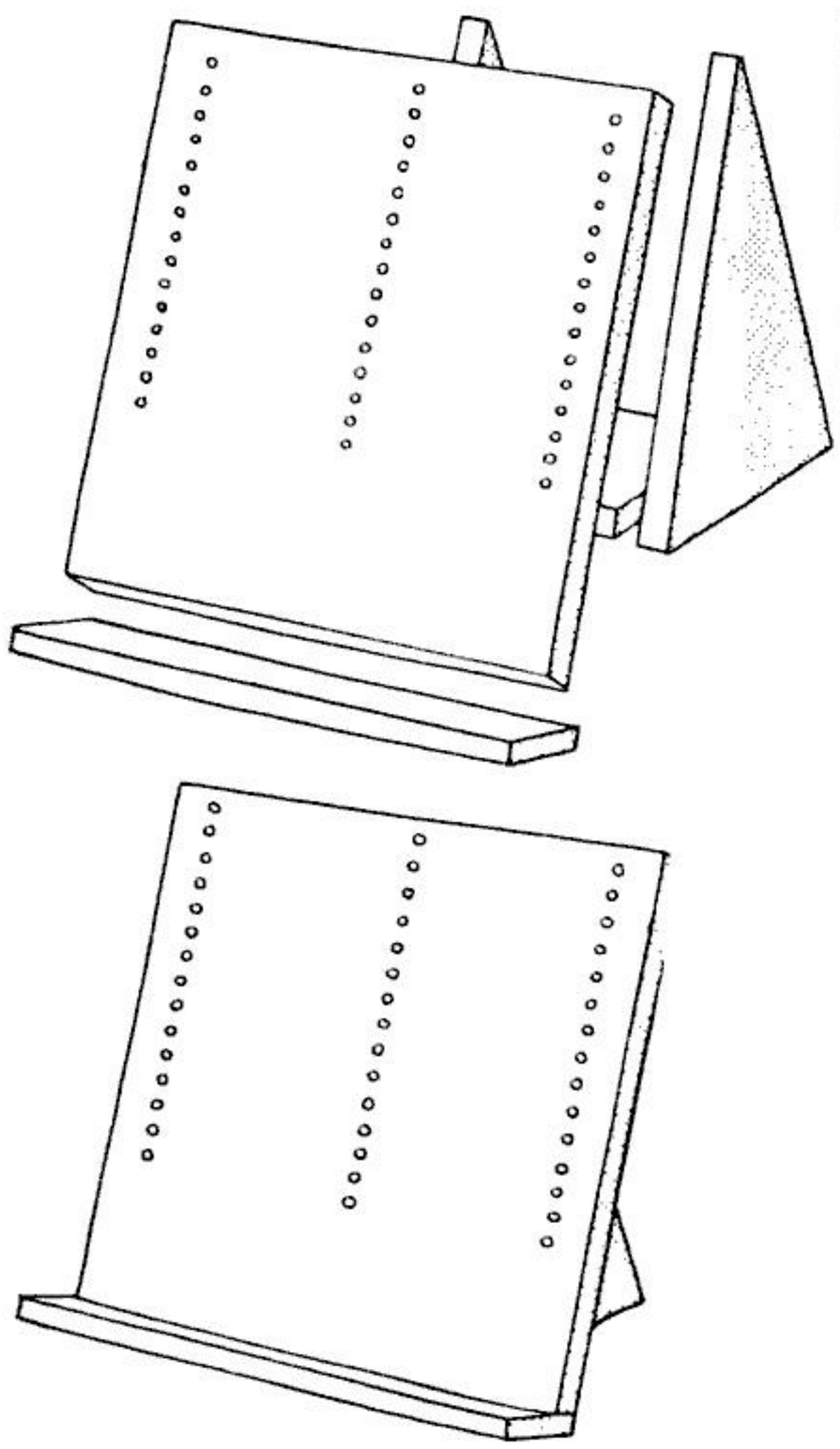

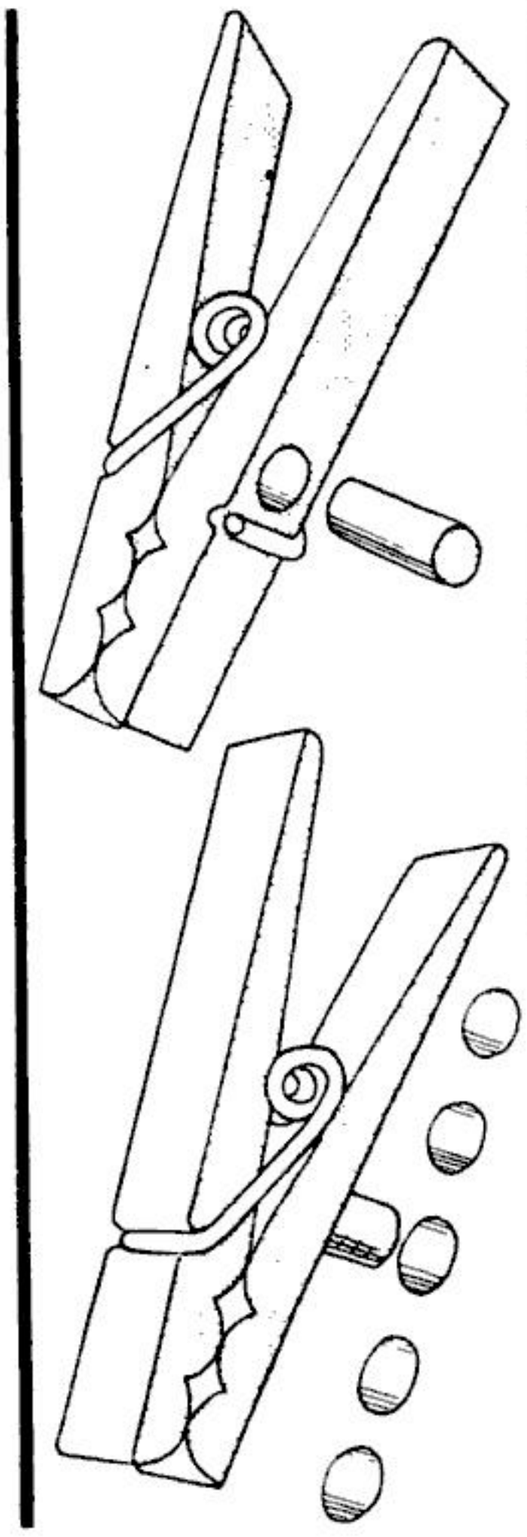

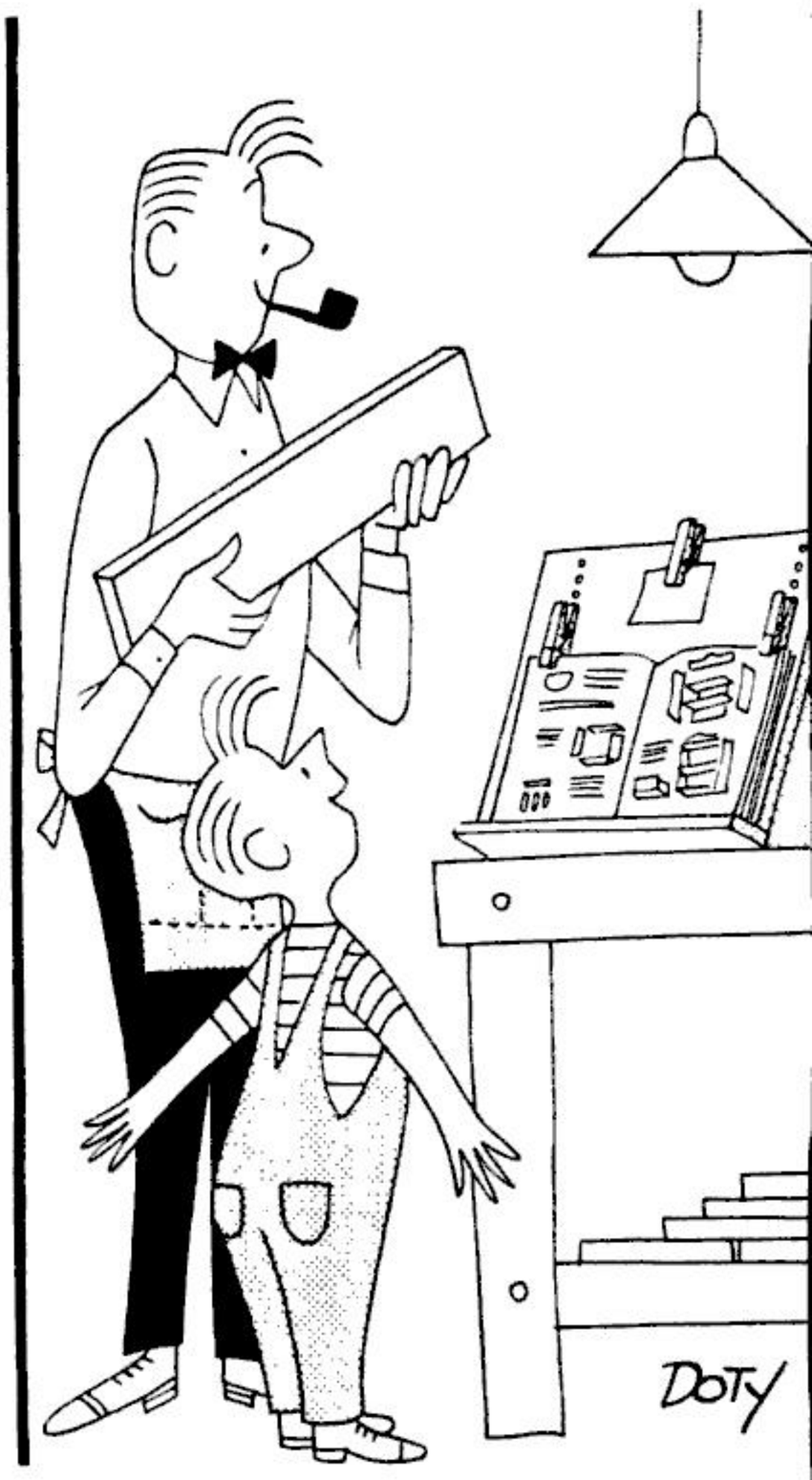

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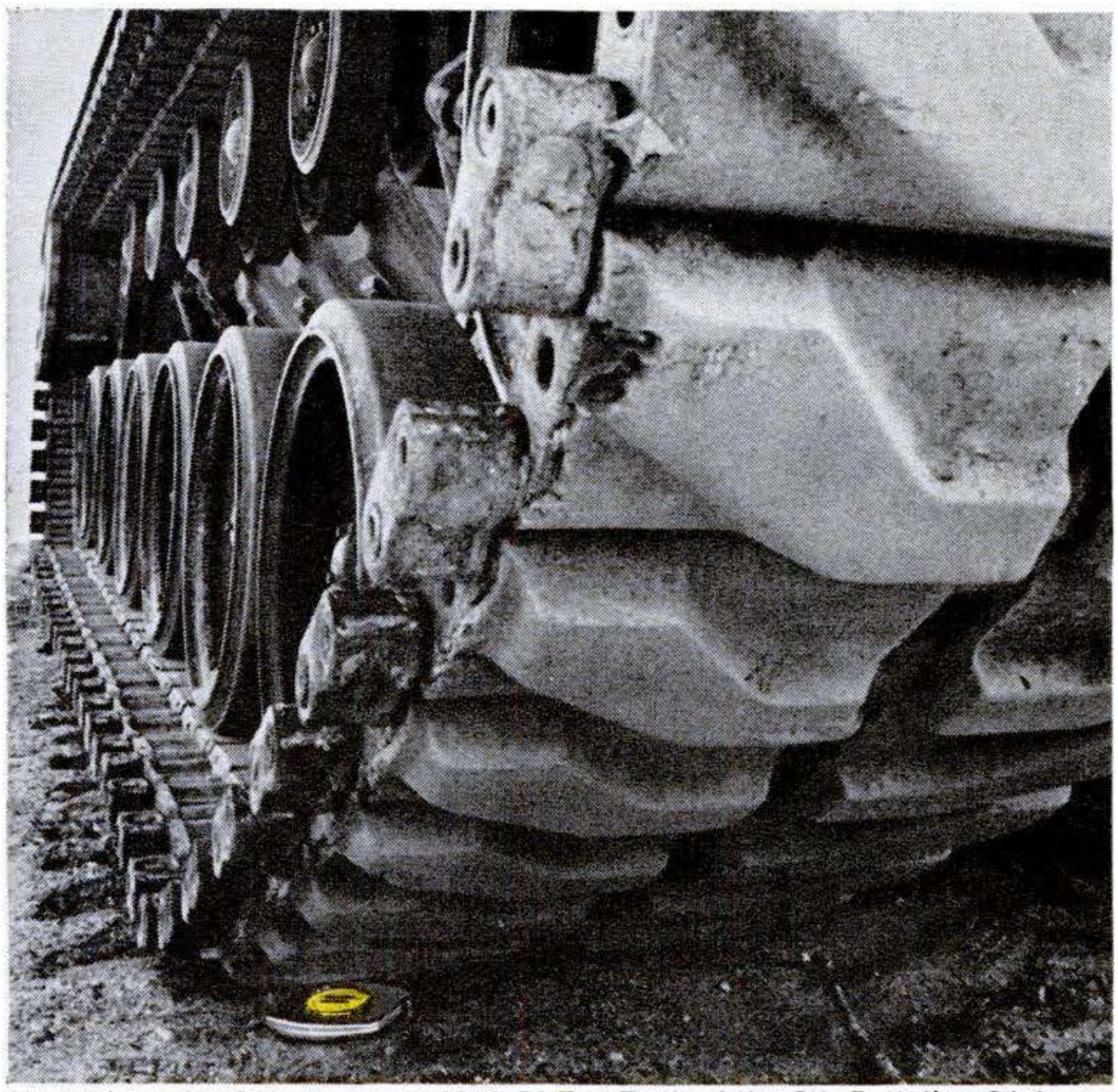
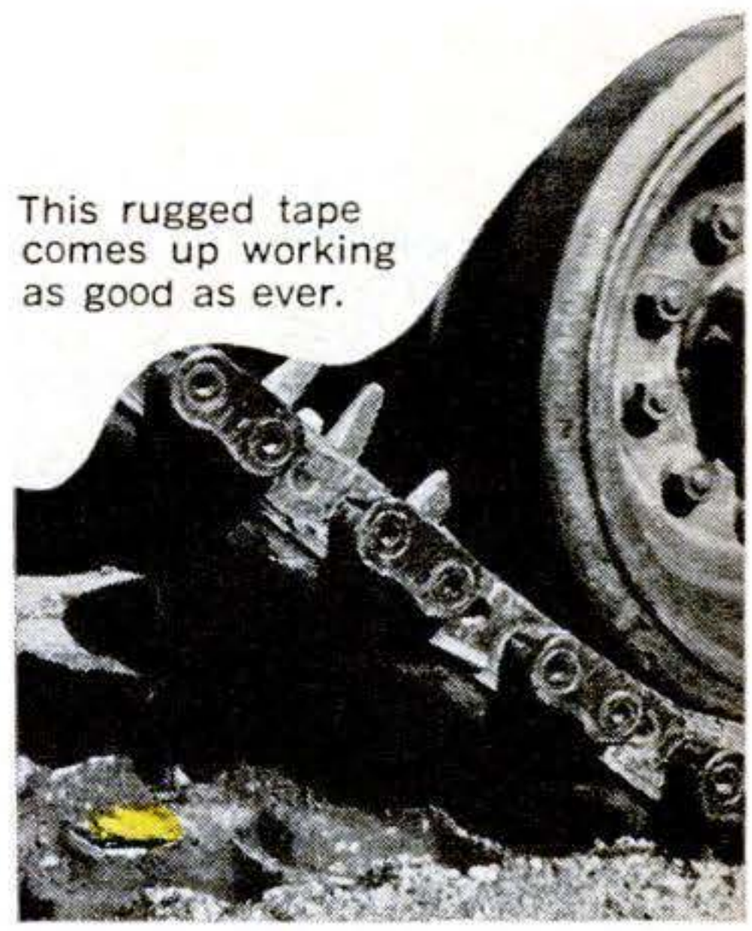


November 16, 1966: a huge M48A1 50-Ton Tank of the 9th Battalion 34 Armor rolls over a Stanley "Steelmaster" No. MY100A Long Tape.



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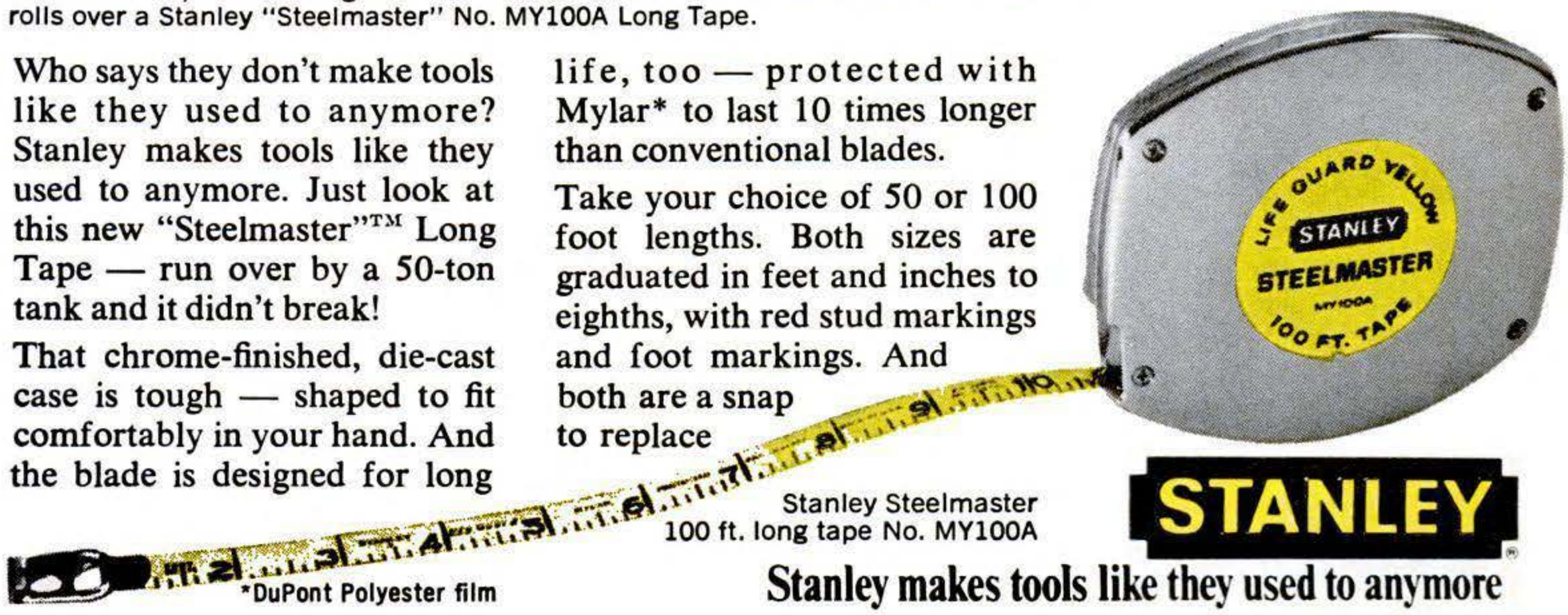

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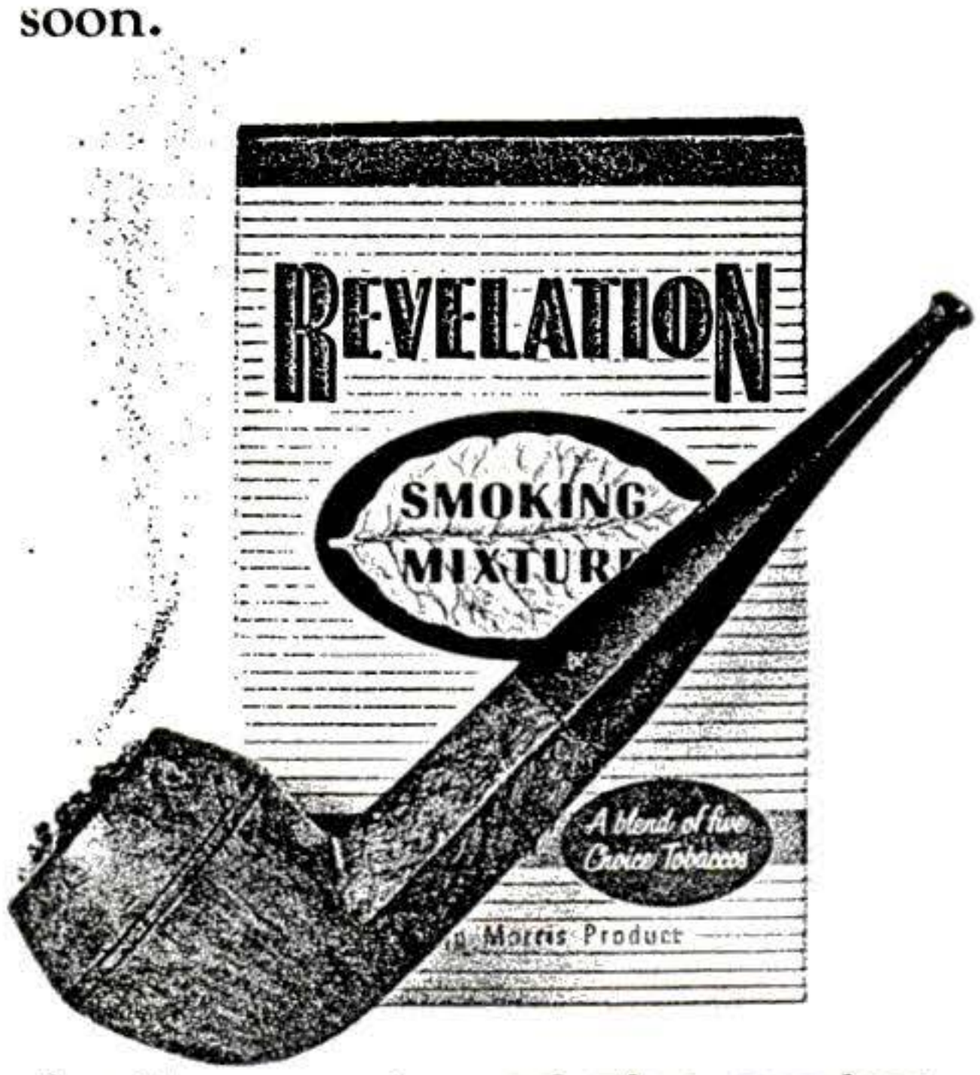

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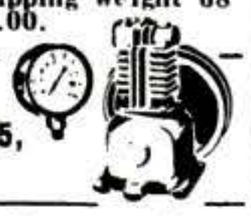

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[*Continued from page 65*]

starting with the plans only ($9.95) for the purist do-it-yourselfer, on up to a completed car ($1,995) for the less ambitious. In between is the bare chassis ($295), which is a VW chassis shortened and with additional sheet-metal modifications to take the standard kit ($595).

The standard Sportster. This kit requires quite a bit of welding to assemble, and you're much better off (in labor and money) ordering the deluxe ($895) kit—the chassis and standard kits fully assembled. All you do is add the necessary parts from a VW. The super deluxe kit ($1,045) is the deluxe kit plus a roll bar, engine skid plate, extractor exhaust system, and wide-rim (seven-inch) wheels. EMPI also stocks all the chassis-body components, should you need replacements.

Meyers offers two Manx kits. The "A" kit provides the three basic components: body, hood, and dashboard. The body and hood are top-quality fiberglass, laminated to a high-gloss finish combining strength, durability, and low maintenance. The dashboard is styled in a black, grained plastic that is hard to distinguish from leather and has proved to be highly resistant to scuffing. This kit also includes chassis-shortening instructions, and construction steps with exploded drawings. There is a choice of five impregnated colors, or a wide choice (at extra cost) of metalflake colors. The kit weighs 95 pounds and goes for $498.

The "B" kit includes the parts mentioned above plus the windshield, headlights, cowl frame, rear deck, aluminum trim, fender welt, rear body-support brackets, battery-mounting bracket, and all hardware for assembly. It is complete except for wheels. Accessories include a wide selection of wheels, a roll bar, front and rear nerf bars, a skid plate, and a fiberglass sport top. The price is $635 complete.

Assembly of the Manx is a little more involved than that of the Sportster because of the chassis shortening. Most owners farm this work out to a local welder. The body itself bolts right on the VW chassis, using the original bolt holes.

The overall cost of building either one of these fireballs should average out at around $1,200. Considering their versatility, this sure makes them one of the best buys around. PS

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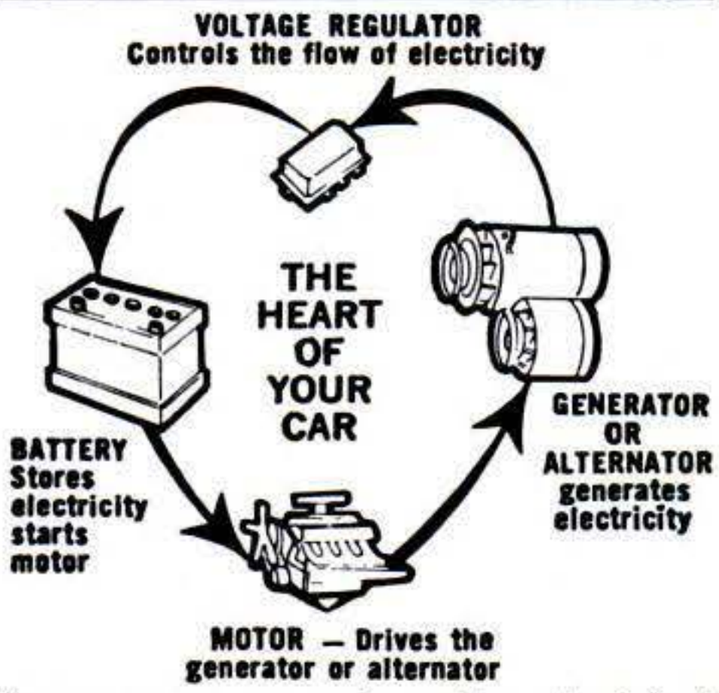

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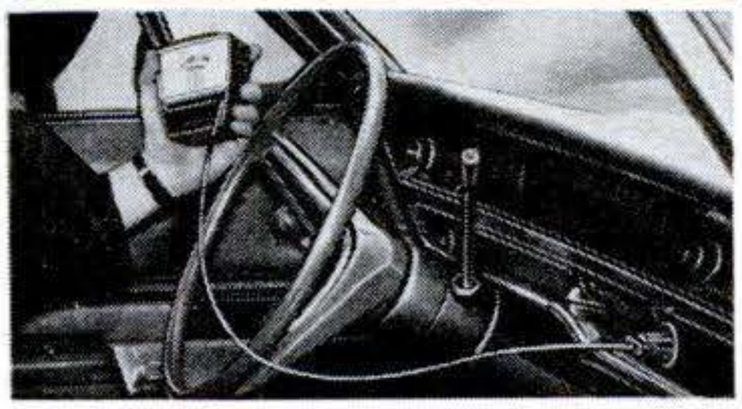

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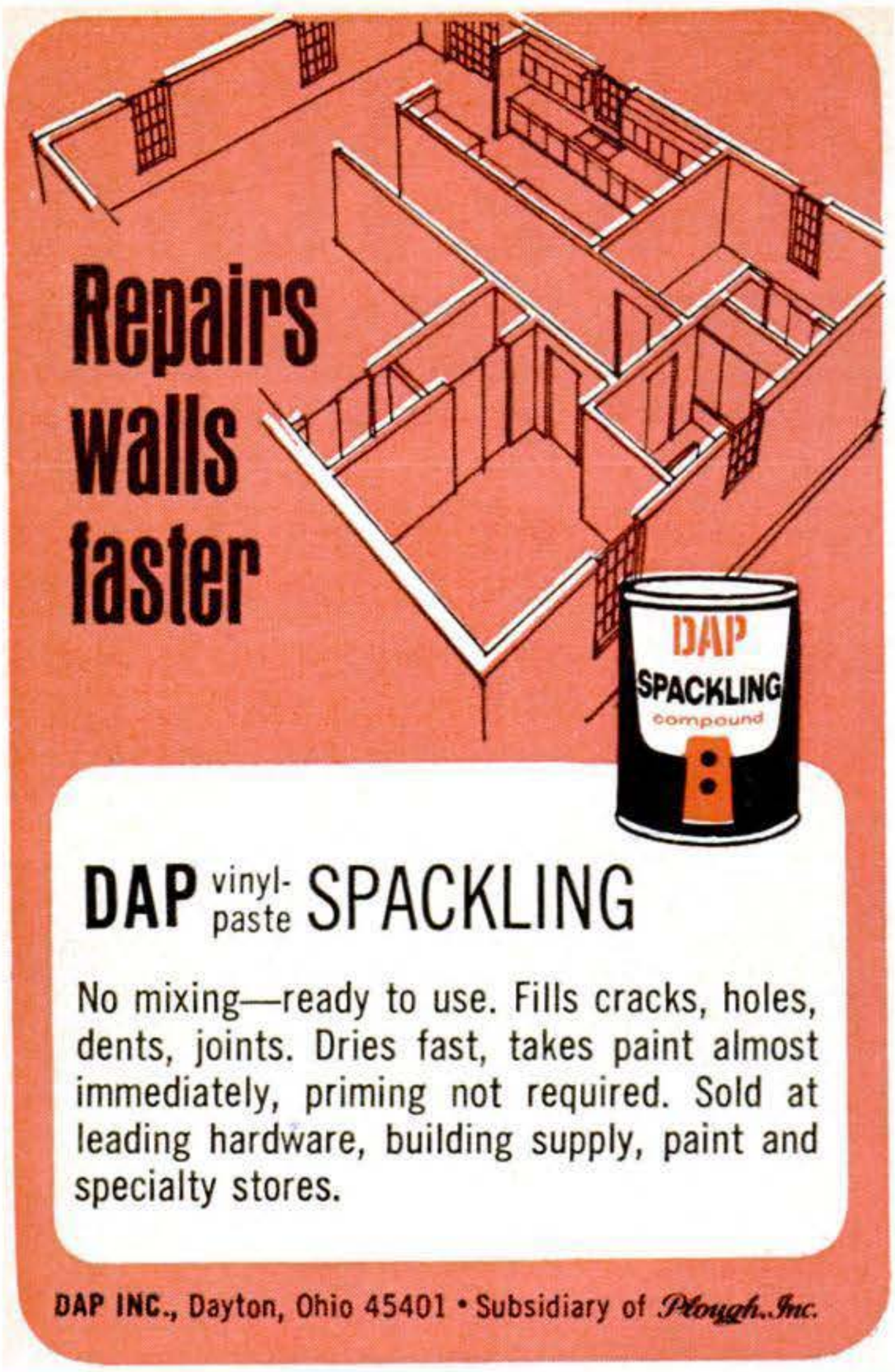

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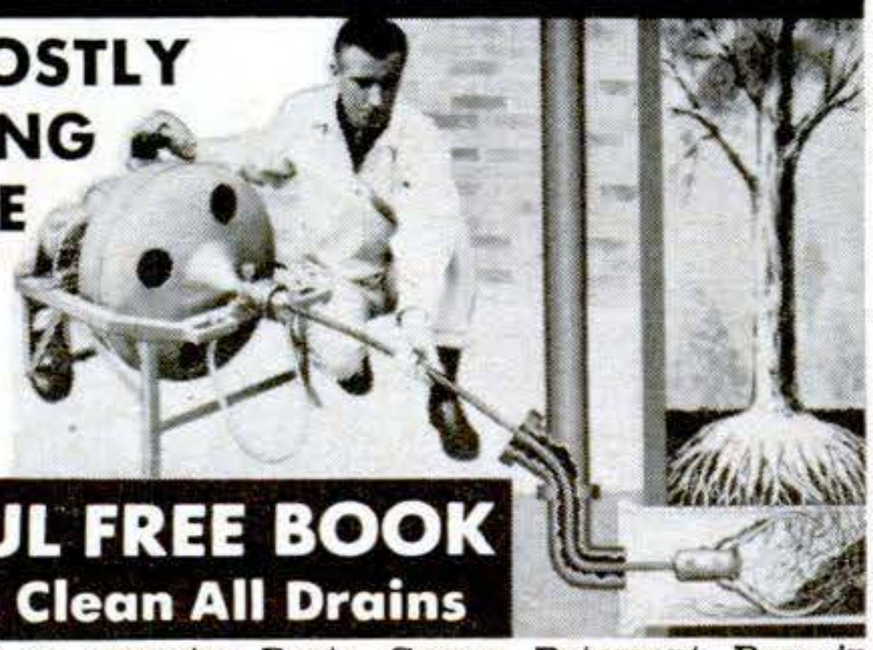

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Weird Problems of Space Walking

[Continued from page 111]

it the emotional effect of floating freely over oceans and continents? Ed White's heartbeat had given no sign that the gorgeous experience overwhelmed him at the rate of one horsepower.

The real problem. Any object freely floating in space has six "degrees of freedom." An EVA astronaut can rotate, like a pirouetting dancer, around his head-to-foot axis; or head-over-heels like a somersaulting diver; or sideways, as though he were strapped to a wagon wheel. The other three degrees of freedom are "translatory"—the astronaut can move in a straight line right-and-left, up-and-down, and fore-and-aft. And to make matters worse, the spacecraft along which the EVA astronaut is moving, or on which he is working, also has six degrees of freedom.

Moreover, in the vacuum of space, present-day space suits are a bit like straitjackets. As you bend an arm, you fight pressure in the suit that tries to keep it straight. Add the fact that a man needs at least one hand to do useful work, and you see the real nature of the problem:

It was a full-time and exasperating job for an EVA astronaut just to stabilize himself in front of his work station, and he would have little attention and strength to spare for anything else. Ed White, whose only task was to stabilize himself at the end of a tether with his gas gun, did not run into this problem—but his successors, who tried to perform "space riggers'" functions, certainly did.

Applying the lessons. The Gemini 12 EVA test benefited from these experiences.

"Buzz" Aldrin prepared himself painstakingly. Wearing a Gemini pressure suit weighted down to neutral buoyancy, he spent a total of 12 hours underwater, maneuvering around a submerged mock-up of the spacecraft. Rehearsing his entire program of extra-vehicular tasks, he conducted time and motion studies for each job planned, and determined the number and length of needed rest periods.

Engineers of the Manned Spacecraft Center fitted him with a restraint harness that could be hooked, window-washer style, to rings attached to the spacecraft.

A happy answer to an EVA astronaut's problems in moving about turned out to be large patches of Velcro—a material, com-

 Continued

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Admiral Byrd, says sources quoted by Dr. Bernard, led a Navy team into the polar opening and came upon this underground region. It is free of ice and snow, has mountains covered with forests, lakes, rivers, vegetation and strange animals. The news of his discovery was suppressed by the U.S. government in order to prevent other nations from exploring the inner world and claiming it.

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bining tiny hooks and loops, that is gaining popularity as a kind of "tear-away" fastener for raincoats and the like. Push one piece of Velcro into another, and the two stick firmly together—but you can peel them apart like adhesive tape. Aldrin carried two Velcro hand pads shaped like cement trowels, and pressed them against Velcro strips previously attached along the outside of the spacecraft. This gave him support and stability as he went to his various work stations.

As the principal feature of his elaborate EVA program, a work panel on Gemini 12's rear adapter section provided 17 different tasks. They included such typical space-repair jobs as cutting cables, turning bolts with a torque wrench, and disconnecting and reconnecting snap-on pressure fittings, locking electrical plugs, and Microdot electrical connectors.

To do this work, Aldrin slipped his feet into two large stirrups, called "golden slippers" for their temperature-controlling color. Then he hooked his restraint harness to the rings on the spacecraft. In this firmly anchored position, he was able to complete his experiment program within the allowed time and without undue strain. He made his way back and forth along the craft's exterior as though he had done it many times before. All the while, his bantering exchange over the intercom system with his command pilot, Capt. James A. Lovell, evidenced that rather than being winded or exhausted, he was having a wonderful time. His "space walk," and two picture-taking stand-ups that he performed in an opened hatch, totaled a record five hours and 36 minutes of EVA.

What's ahead. Successful completion of the Gemini EVA program has paved the way for bigger things to come. Future space missions requiring EVA will include:

- Erection of large antennas in space for communications and radio astronomy.
- Assembly of large space stations, and of manned interplanetary space vehicles that are put into orbit in several prefabricated sections.
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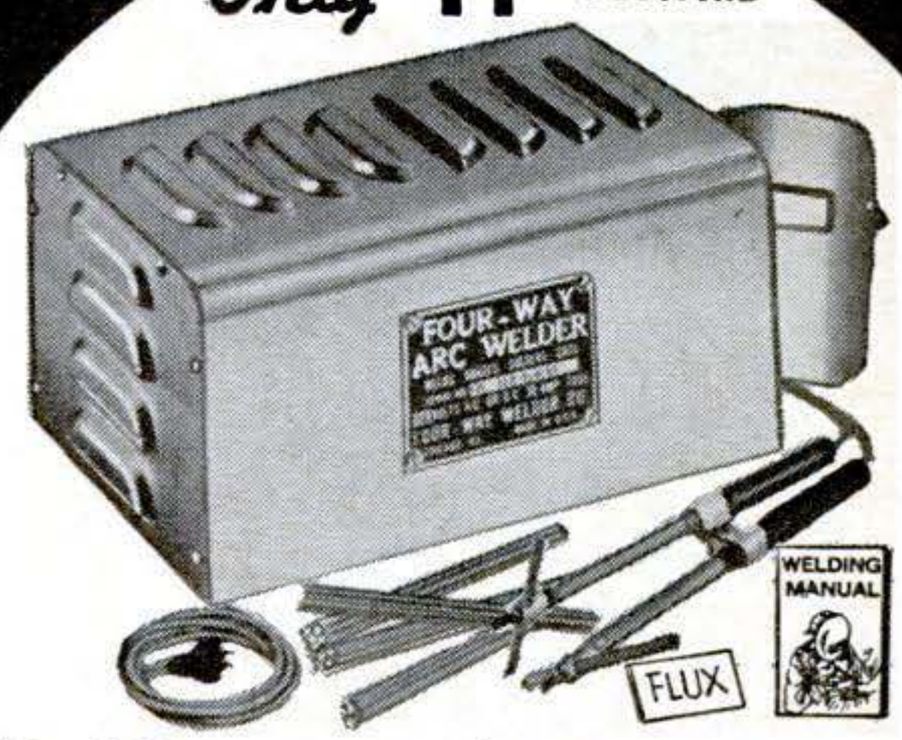

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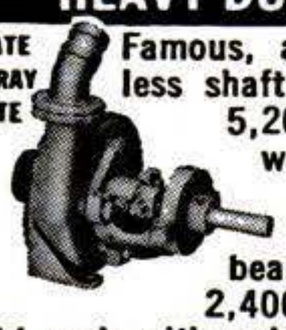

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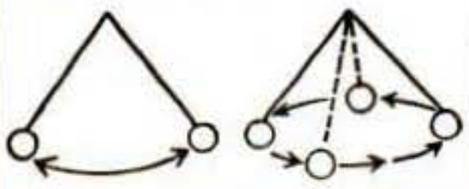

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I Crossed the Atlantic in a 12-Foot Sloop

[Continued from page 99]

starboard instead of port, dropping me into the sea on my back. Chilled to the marrow, I clambered around on top of the horizontal mast and reeved the halyard once again.

More squalls. I got the jib up just in time, for by 8:30 I was running full reefed before a heavy blow from the south, and later had to lay to. Squalls took me 60 miles too far north. There was more fog, and the radio quit because of dampness. On July 6th, I spotted three sperm whales about a mile away. A quickening breeze brought us together, and I tried to steer between two of them. One blew only 10 feet astern, raising his head as if to ram the boat. A moment later he submerged, with a swish of his tail that left a great boil on the surface.

On the 8th, the radio dried out and I picked up a Dublin station—speaking Gaelic! Next day I tried to run before a squall from southwest, but by night I was forced to lay to in gale winds. I made poor headway next day, got almost no rest that night, and was becalmed after midnight.

But the sun came out briefly on the 11th and I worked a fix that put me less than 50 miles from Inishtearaght Light!

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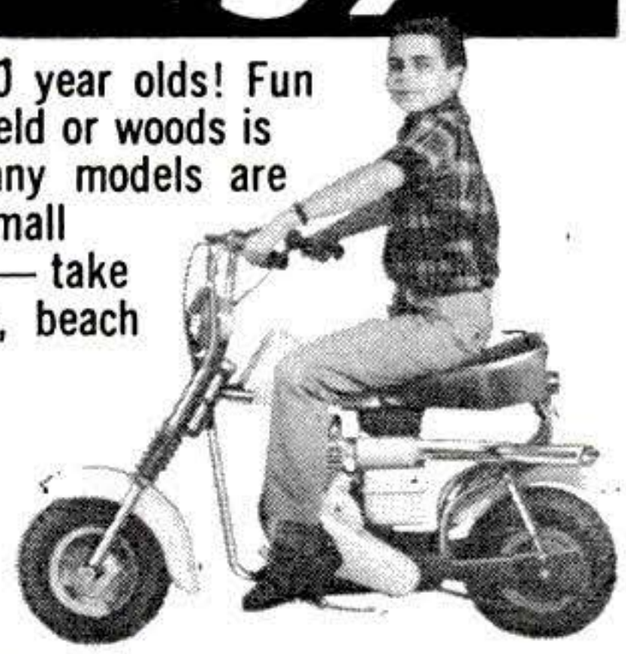

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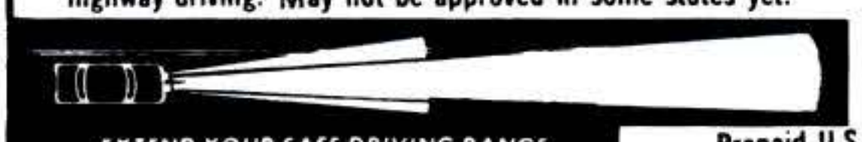

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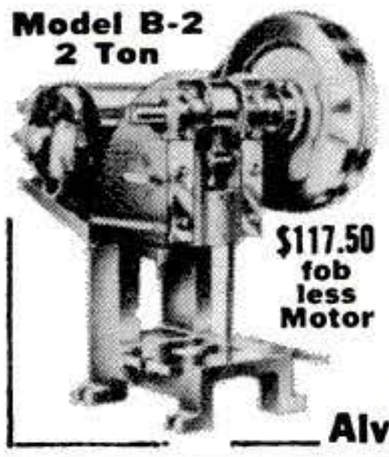

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Smart Tricks for Finishing Fir Plywood

[*Continued from page 166*]

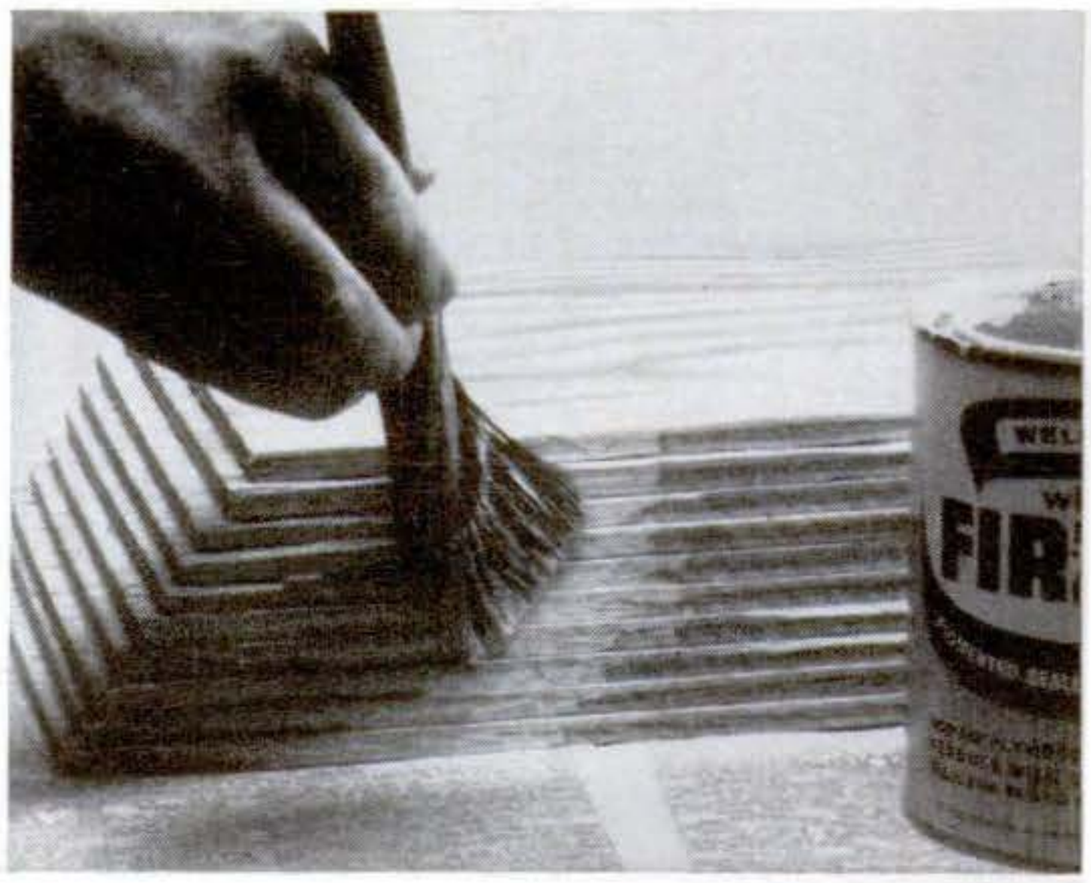
with semigloss enamels on indoor projects.

What about textured plywoods? Firply is made in dozens of textures such as the Surfwood and Weldtex of U.S. Plywood and the industry-wide Texture 111. The swirled or striped surfaces of these textures obscure both the wild grain and the tendency to check. In addition, they provide opportunity for some interesting novelty finishes, some of which are shown in color on a previous page.

The trick used for most of these finishes is a base color, over which you apply a second color in some manner that takes advantage of the texture. These techniques include:

1. Spraying at a flat angle, so that color is deposited on only one side of the textured wood surface.

2. Brush on, wipe off, leaving color in the depressions and more or less removing it from high spots.



Seal plywood edges before completing a project, especially if they'll be inaccessible after assembly.

3. Applying the second color with a hard roller that bridges the low spots and colors the high.

Additional interesting effects are possible with single colors, especially on surfwood, which is a sand-blasted surface. Much of the soft wood is removed, and what remains has a pebbled surface. When you brush on a semigloss enamel, it holds its sheen on the hardwood and goes quite flat over the pebbled surfaces. As with several others, this novelty finish on textured firply seems to shift and change as you move past it and angles of light change. PS

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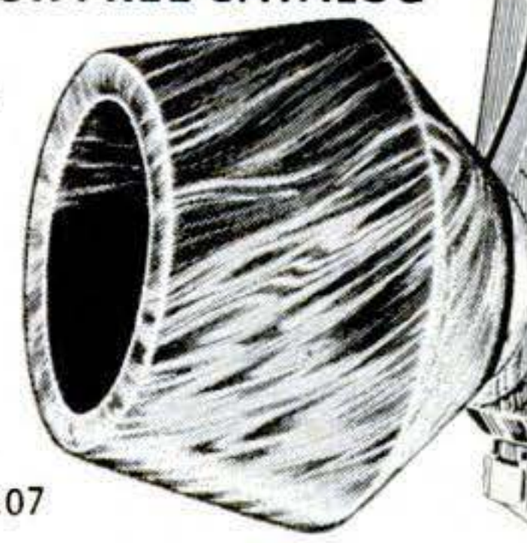

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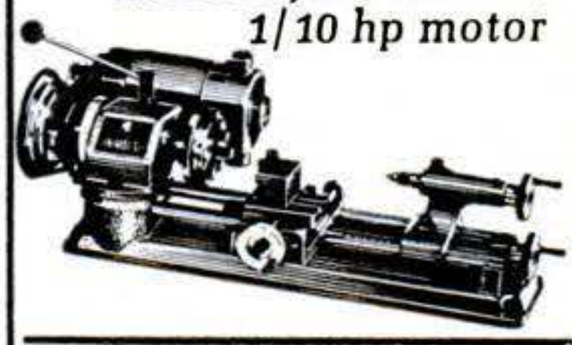

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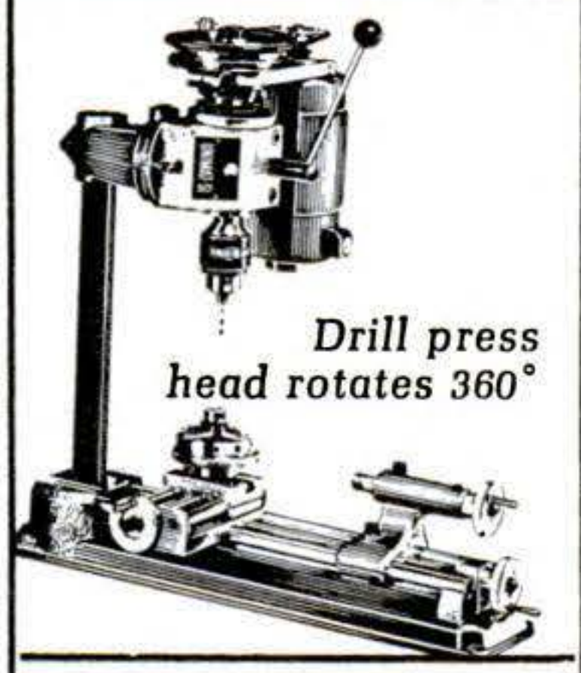
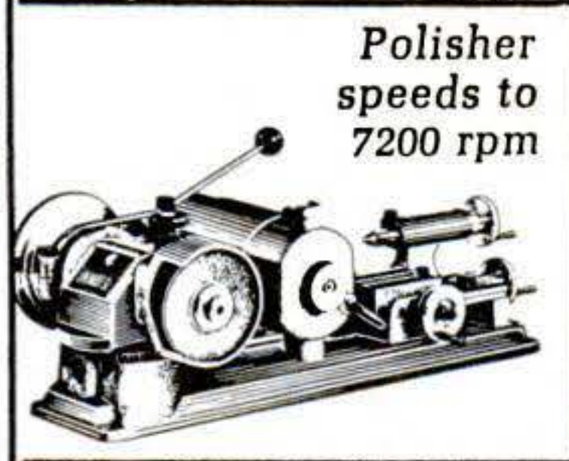
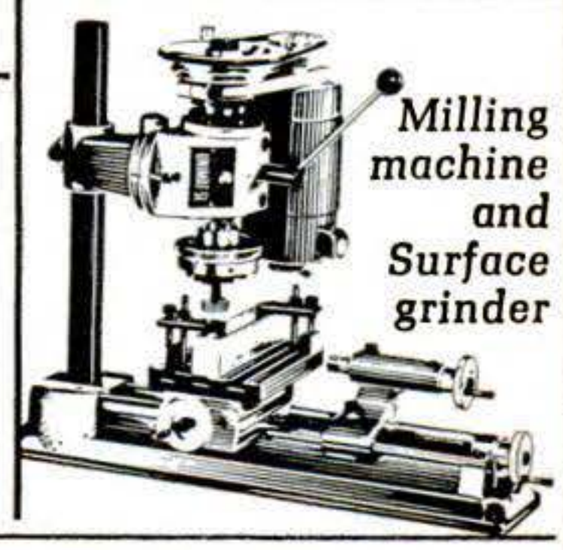


Drill press head rotates 360°



Polisher speeds to 7200 rpm



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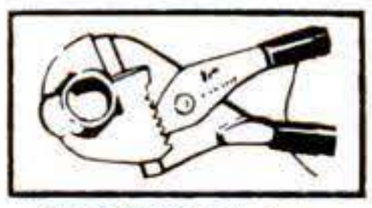

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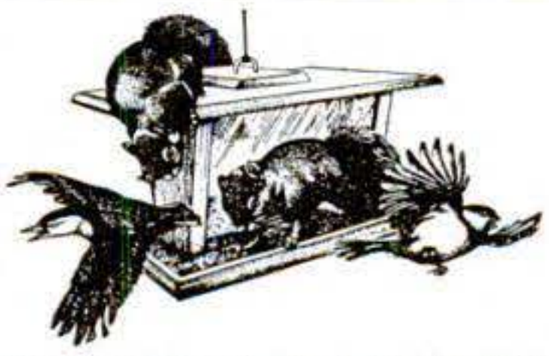

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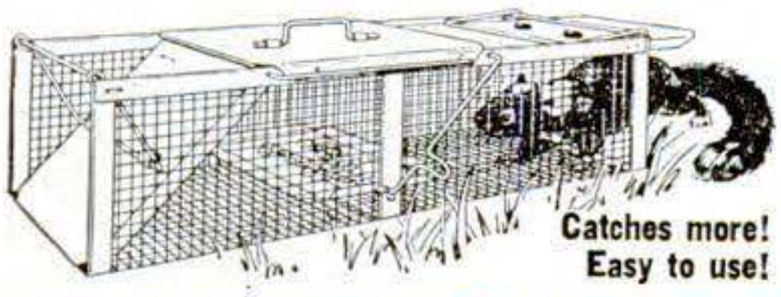

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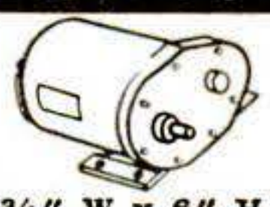

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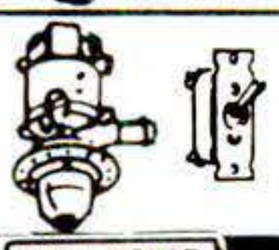

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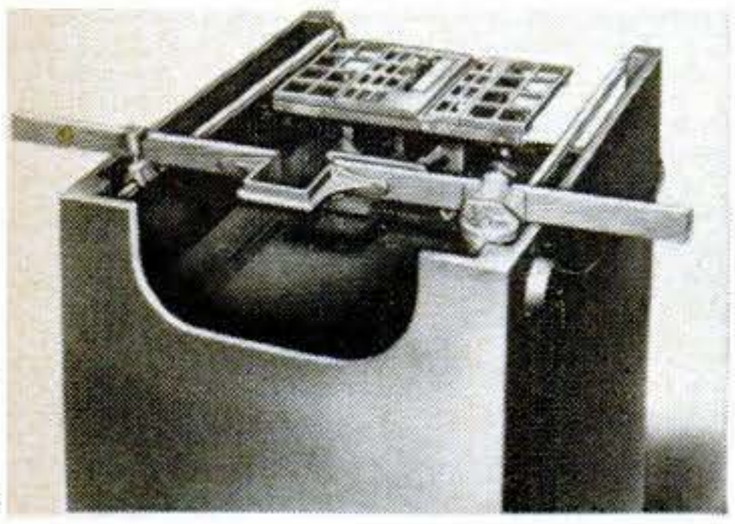

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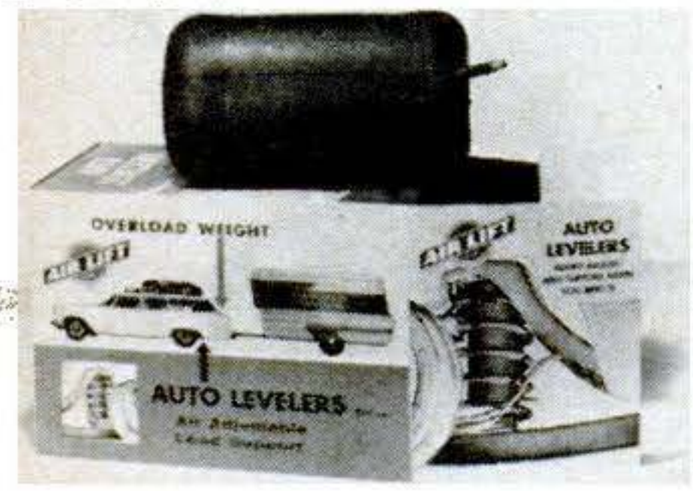

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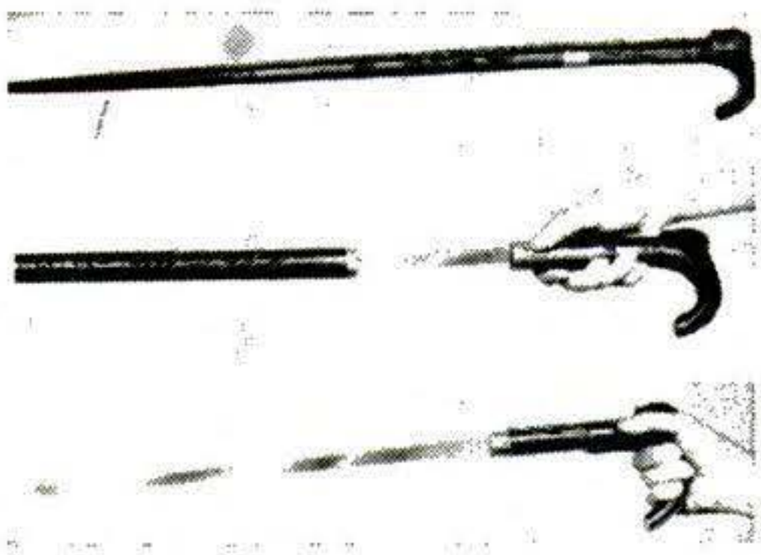

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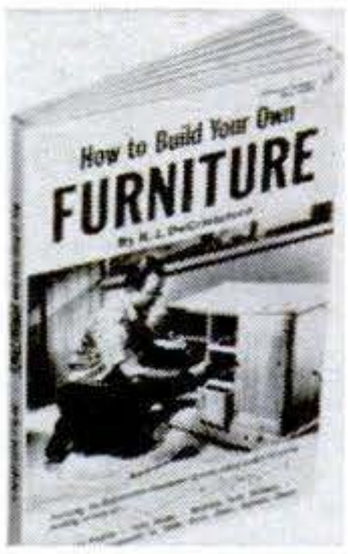

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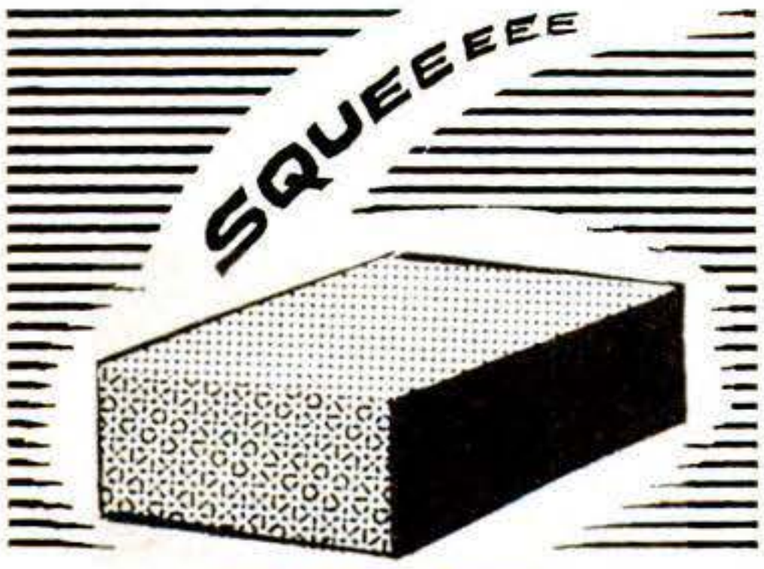

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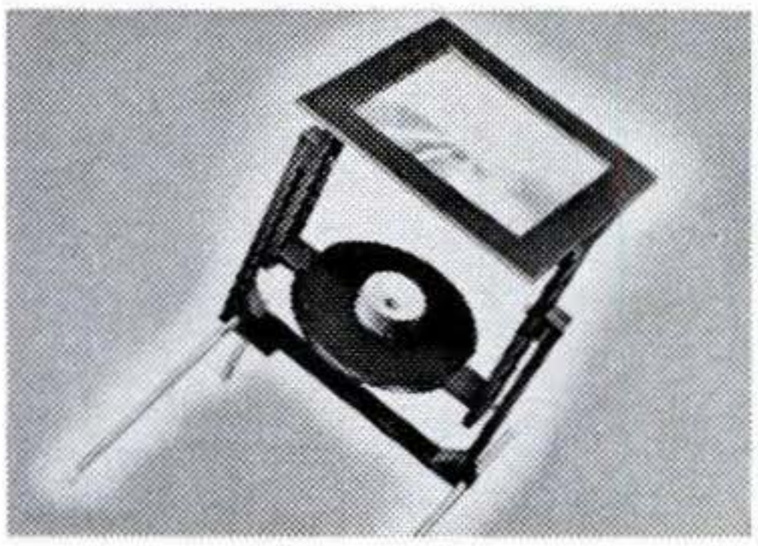

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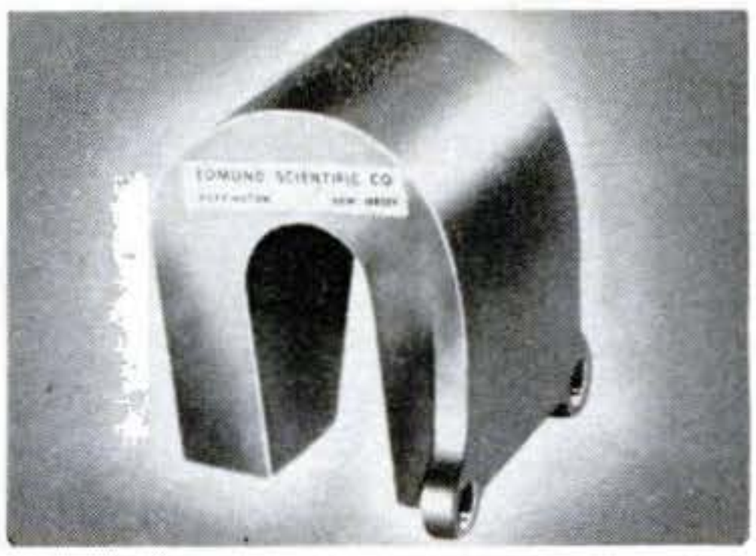

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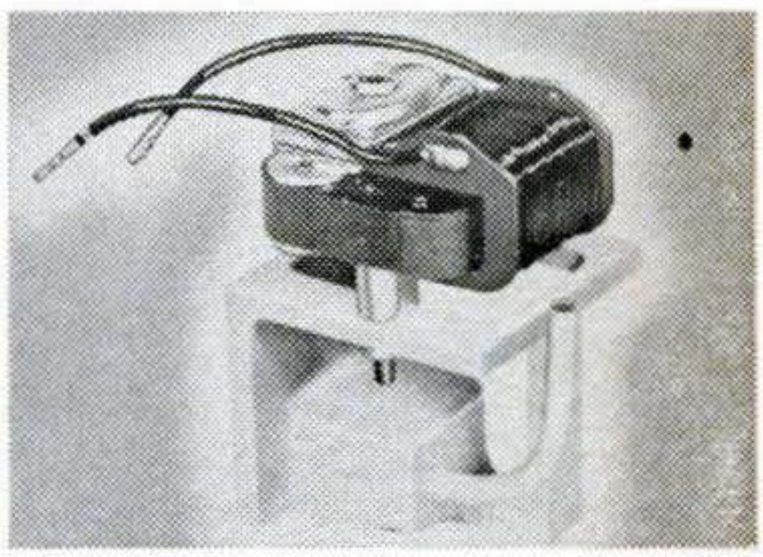

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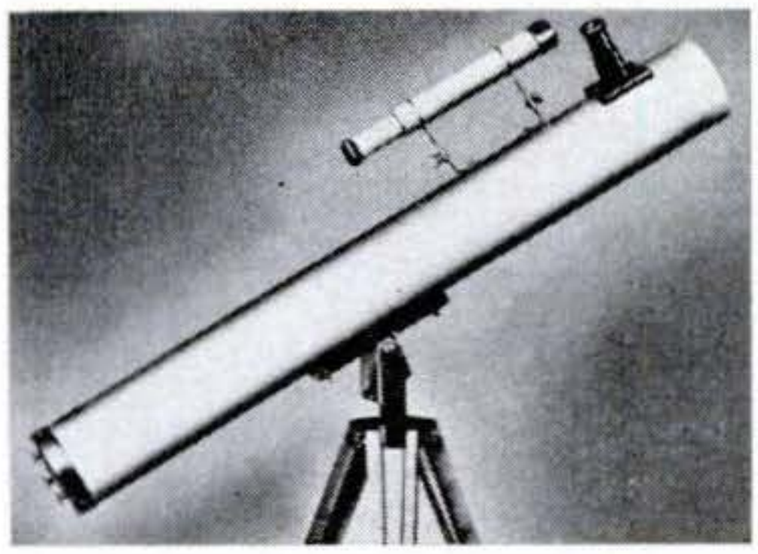

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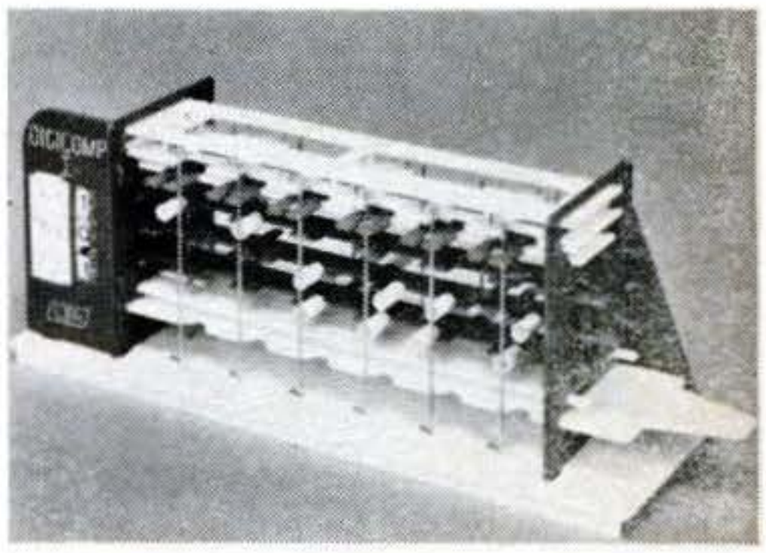

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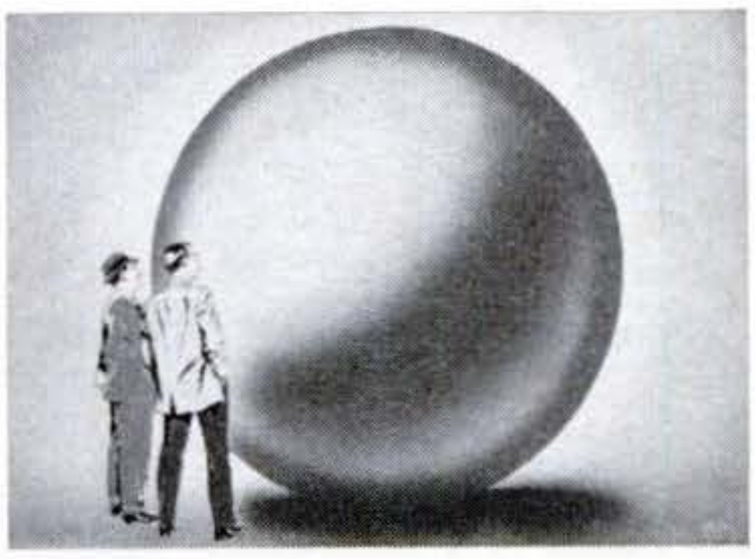

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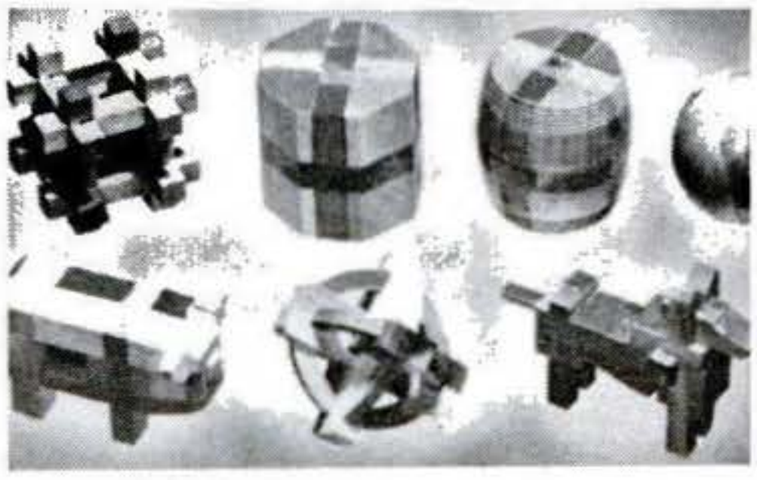

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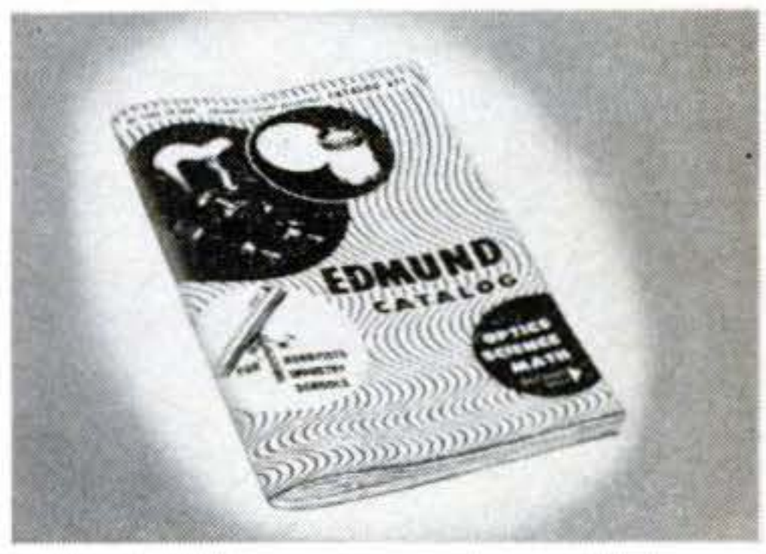

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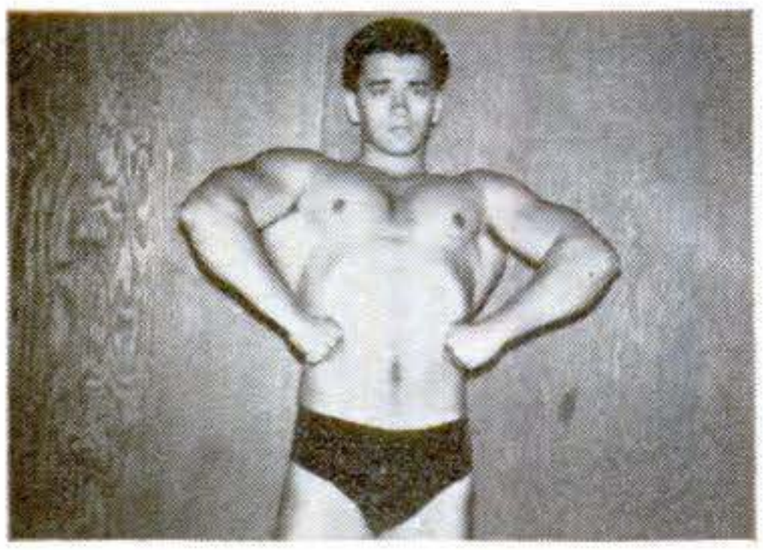

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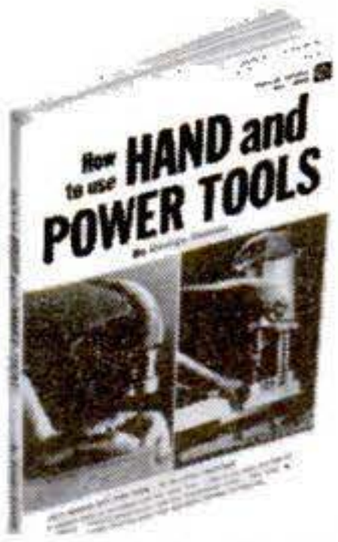

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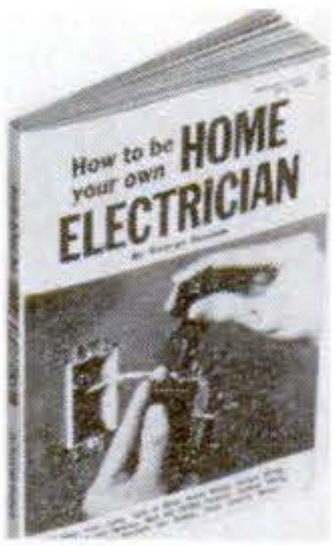

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- ☐ Disc Sander at $7.95†

½ hp GE Motor { ☐ $14.80 (purchased with other item) ☐ $18.95 (if purchased separately)

NAME .....
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CITY ..... ZONE/ZIP ..... STATE .....

SAVE AS MUCH AS... 80% WITH QUALITY Amco POWER TOOLS

DIRECT FACTORY OFFER AND REVOLUTIONARY PATENTS decrease costs, increase efficiency. Full scale power tools of heavy duty 100% cast iron and steel. Streamlined design reduces weight, cuts material and production costs. Special patents provide added efficiency, accuracy, savings. Parts made, assembled, tested, packed right in our own factories shipped direct...save store profits.

UNCONDITIONAL 10-DAY MONEY BACK GUARANTEE
You must be fully satisfied. If not, return in 10 days, freight collect. Money promptly refunded in full.

ENDORSED BY AMERICA'S TOP MAGAZINES... Here is what the editors say: "A good bit of sound—imaginative—engineering." Popular Science; "(saw) boasts many features of bigger brothers." Popular Mechanics; "Amazingly versatile." Workbench; "Highly substantial construction, sturdy enough for production line use." Industrial Woodworking. And Workbench awarded these tools their coveted "Work Tested" Seal.

OVER A MILLION USERS confirm their precision, versatility and rugged performance.

✱10-YEAR FULL SERVICE GUARANTEE . . . Any part or parts of any AMCO power tool (except motor) which may become inoperative for any reason within **ten years** after the purchase date will be repaired or replaced by the factory without cost to the purchaser. Your only cost: for postage.

8" TILT ARBOR POWER SAW

DOES WORK OF $75 BENCH SAW as is. Converts easily to equal any $300 floor model cabinet units! Crosscuts, rips, mitres, cuts compound angles, dadoes, makes coves and mouldings.

$14.95 f.o.b. factory. Wt. 25 lbs. Includes completely assembled cast iron and steel 8" saw with ground cast iron table . . . less blade. RIP FENCE, if desired, for easier work alignment, $3.50 add'l.

SAW BLADE TILTS . . . TABLE STAYS LEVEL • Locks securely at any angle up to 50°, raises, lowers 0"-2¼". Patented tilt mechanism, accurate etched scale. Patented motor mount takes std. ¼ h.p. or larger motor, keeps belt tight, assures perfect alignment at any angle, transmits full power. Takes std. blade, saw insert removes to take dadoe heads, cutters, etc. (not incl.). Accurate mitre gauge assembly. Ground spindle. Enclosed steel base. "Compo" bearings. Accessories available at factory prices. RIP FENCE, if desired for easier work alignment: Std. size (for bench saw) $3.50; larger fence (for cabinet base, as ill'd.) $4.50.

FREE CABINET BASE PLANS Use as portable bench saw as received (inset photo) . . . or transform easily and inexpensively into floor model (as shown) guar. to do work of floor models costing $300. FREE plans . . . all you'll need are a sheet of ¾" plywood and 3-4 hours. Use your AMCO saw for cutting. Plans provide 27" x 24" work surface, 33" height, tool storage compartment.

10-YEAR FULL SERVICE GUARANTEE*

6" SWING 3-FOOT LATHE

$9.85 f.o.b. factory Wt. 14 lbs.

Optional faceplate for turning bowls, trays, lamp bases, rosettes, etc. $2.50.
Set of 3 high speed turning chisels, $4.95 add'l.

DOES THE WORK OF $40 UNITS . . . with same precision and speed. Turns wood, plastic. Sturdy cast iron with tubular steel bed. Ball thrust cup center, spur center, T-rest assembly, lever action tail stock, 2-speed pulley. Fits any motor.

10-YEAR FULL SERVICE GUARANTEE*

FULL 22" LONG, 4⅛" JOINTER-PLANER

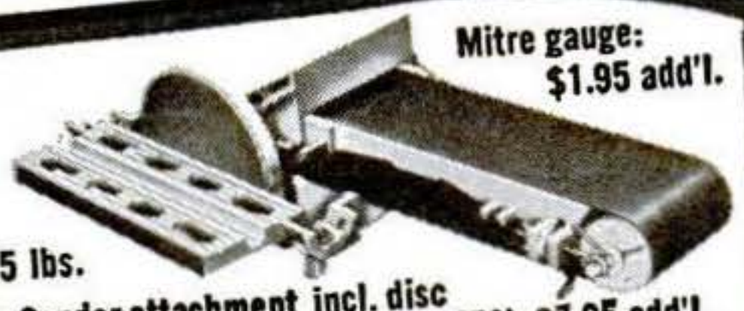
$19.95

f.o.b. factory. Wt.: 19 lbs. Complete as shown.
100% precision ground cast iron and steel.

DOES THE WORK OF $60 UNITS . . . Professional power planing at a hand tool price. Make faster, more accurate joints, rabbetts, bevels for windows, doors, drawers, square tapered legs—Adjustable precision ground cast iron tables. Patent-pending design holds knife to table clearances at any depth. Rabbett depth ⅜". Fence adjustable 0°-50°. Hardened, ground hi-speed steel knives. Dual cutter guards. Balanced cutter head.

10-YEAR FULL SERVICE GUARANTEE*

PRECISION 4" x 36" BELT SANDER



Mitre gauge: $1.95 add'l.

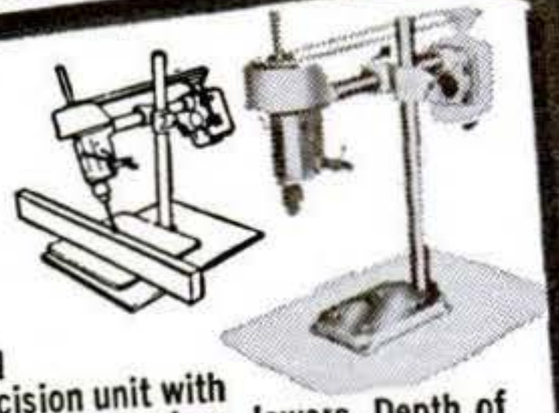
f.o.b. factory. Wt. 15 lbs.

$14.95 †Disc Sander attachment incl. disc bracket, ground cast table (tilts 0-45°): $7.95 add'l.

DOES WORK OF $50 SANDERS . . . The world's most talented belt sander. Heavy cast sander incl. 4" x 36" sanding belt, V-pulley drive, multi-purpose drive spindle. Changes from horizontal to vertical sanding in secs. Uses ⅓ hp or larger motor.

10-YEAR FULL SERVICE GUARANTEE*

32" RADIAL DRILL PRESS



All cast iron and steel
f.o.b. factory Wt. 30 lbs.
½" cap.
Jacob's chuck incl.

$29.95

DOES WORK OF $90 UNITS . . . and much more. Industrial quality precision unit with all standard features, many extras. Head raises, lowers. Depth of throat up to 16". Pre-set to any angle for on-or-off table drilling, even horizontal drilling. **10-YEAR FULL SERVICE GUARANTEE.***

BRAND NEW GE ½ H.P. MOTOR...$14.80 F.O.B. FACTORY / FOR ANY OF ABOVE MACHINES. WT. 17 LBS. PURCHASED SEPARATELY, $18.95

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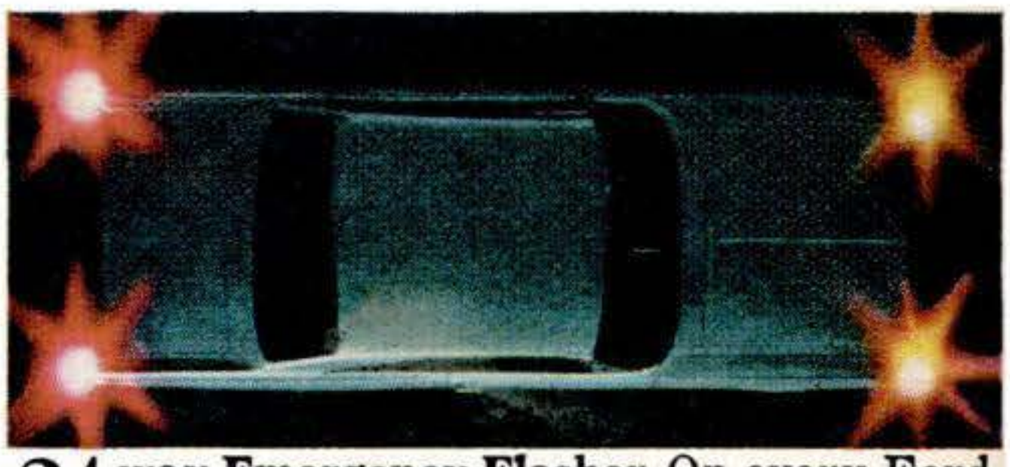
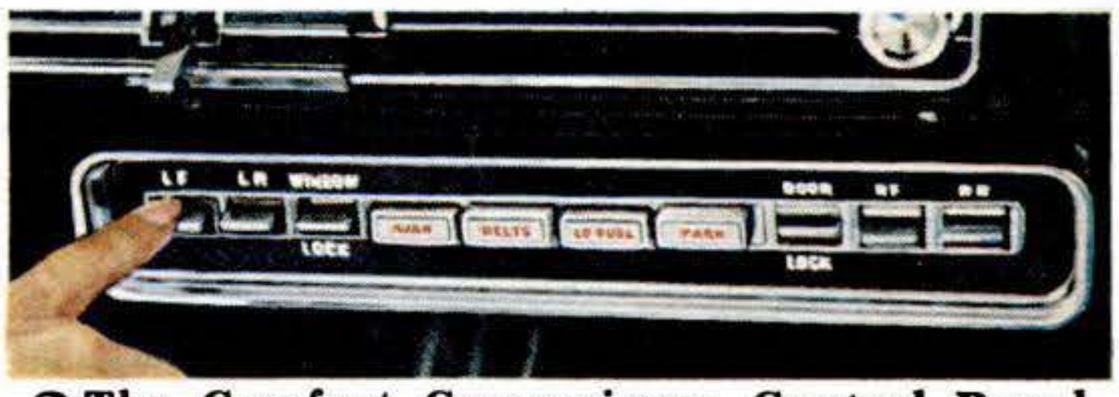
If they start as better ideas, they stay better ideas.

Here are four better ideas we came up with last year.
Four Ford Motor Company exclusives you gave a good, running start.
They're still better ideas. So you get them again in '67.



2 4-way Emergency Flasher. On every Ford Motor Company car. When you are parked and you turn on the 4-way flasher—2 lights in the *front* blink on and off; 2 lights in the rear blink on and off. And this year, we put the switch right on the steering column. Handier than ever.

1 The two-way tailgate. Exclusive! Only Ford and Mercury wagons have it. Use the handle on the side, it opens like a door. Use the handle in the middle, it operates as a tailgate. Something else: you can get side-facing rear seats; makes a kid's playroom out of the back end.



3 The Comfort Convenience Control Panel. Available only on Ford Motor Company cars. Individual lights flash on to tell you 1) that your doors aren't properly closed; 2) remind you to fasten your seat belts; 3) that you're low on gas; 4) that your parking brakes are still set.

4 Stereo-Sonic Tape System. Another first from Ford. Just snap in a tape cartridge and you have stereo sound surrounding you from as many as 4 speakers! Optional.

Ford Motor Company was first with these better ideas.
And there are lots more where they came from for '67.

Ford

...has a better idea

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Your Ford Dealer has more than 20 sound systems for your car.

(Let him give you an earful)

Sound is an ever-changing kaleidoscope. It can be red-hot in excitement . . . picture the green coolness of spring . . . be anything you want. Your Ford Dealer can give you the sound you love best . . . in your car.

He has radios up to the smoothness and fullness of Stereo FM. Or, if you have strong personal preferences . . . see him about a Stereo-Sonic unit. You can select from tape cartridges for music from opera to Dixieland to symphonies to your favorite "five."

For those who have to "see" their sound, he has a portable TV for back-seat viewing.

He has sound systems for business as well. Two-way radios keep you tied to home base wherever you are. For the ultimate in mobility, try our handy walkie-talkie.

For anything or everything you want in sound systems . . . your Ford Dealer is a musical maestro.

Ford

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